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IDI

STI
043110AAC

February 13, 2017

Illinois EPA, Bureau of Air
Compliance and Enforcement Section (MC 40)
1021 North Grand Avenue East
PO Box 19276
Springfield, Illinois 62794-9276

RE: Notification of Compliance Status
Sterigenics' Willowbrook, IL Facility, I.D. No.: 043110AAC
Permit No.: 95120085

(A) no review
JL 2-15-17
RECEIVED
STATE OF ILLINOIS
FEB 14 2017
ENVIRONMENTAL PROTECTION AGENCY
BUREAU OF AIR

IEPA - DIVISION OF RECORDS MANAGEMENT
RELEASABLE

Dear Sir:

This Notification of Compliance Status is being sent pursuant to 40 CFR 63.9(h) for Sterigenics' Willowbrook, IL facility. The facility is subject to the NESHPAP emission standards at 40 CFR 63.362. On December 12-13, 2016 annual performance testing of the facility's Deoxx Scrubber at Willowbrook I (WB1) facility and the AAT Scrubber/Drybed at Willowbrook II (WB2) was conducted per the work practices requirement stated at 40 CFR 63.363(b)(2)(ii).

FEB 28 2017

Facility Name:

Sterigenics U.S., LLC - Willowbrook Facility
7775 Quincy Street
Willowbrook, IL 60527

REVIEWER: RDH

Method(s) Used to Determine Compliance - Section 63.9(h)(A)

Performance testing of the Willowbrook I facility's Deoxx Scrubber system was conducted on December 12, 2016 in accordance with the test methods in 40 CFR 63.365 for Ethylene Oxide Sterilization Facilities. The WB I facility's AAT scrubber/drybed system previously was tested on January 23, 2003 following test methods stated in 40 CFR 63.365.

Performance testing of the Willowbrook II facility's AAT Scrubber/Drybed system was conducted on December 13, 2016 in accordance with the test methods in 40 CFR 63.365 for Ethylene Oxide Sterilization Facilities.

Performance Test Results - Section 63.9(h)(B)

The December 12th testing of the WB1 Deoxx Scrubber system demonstrated an average control efficiency of 99.9996 % for treating process emissions from the facility's sterilization chamber vacuum pumps. The testing demonstrates the facility conforms to the 99.0% minimum efficiency standard specified in 40 CFR 63.362(d) and the performance standard stated in the facility's air permit. The tested operating efficiency of the WB1 AAT Scrubber/Drybed system on January 23, 2003 was 99.9 %. This performance level conforms to the 99% minimum efficiency standard in 40 CFR 63.362(c) and the 99% or < 1 ppmv control requirement in the facility's air permit.

The December 13th testing of the WB2 AAT Scrubber/Drybed system demonstrated an average control efficiency of 99.94 % for treating process emissions from the facility's sterilization chamber vacuum pumps. The tested operating efficiency of the WB2 aeration emissions through the AAT Scrubber/Drybed system demonstrated an average control efficiency of 99.96%. The testing demonstrates the facility conforms to the 99.0% minimum efficiency standard specified in 40 CFR 63.362(d) and the performance standard stated in the facility's air permit.



Methods to be Used for Determining Continued Compliance Section 63.9(h)(C)

The facility assures continuing compliance with the Section 63.362 standards by measuring and recording the Deoxx and AAT scrubber systems liquor pH and tank level on a weekly basis. The AAT Drybed systems are also tested weekly to ensure outlet emissions are below 1ppmv.

Type and Quantity of Hazardous Air Pollutants Emitted During Reporting Period - Section 63.9(h)(D)

The Willowbrook I facility used approximately 264,951 pounds of ethylene oxide during the 12 month period ending December 31, 2016. Approximately 95% of that amount (251,703 pounds) is emitted through sterilization chamber vents (via vacuum pumps) to the Deoxx wet scrubber system. Using the 99.9996% control efficiency obtained from the December 12th test, the resulting emissions are calculated to be approximately 1 pound per year. Approximately 4% of the ethylene oxide used by the facility (10,598 pounds) represents process emissions from the facility's aeration room which is treated by the AAT Scrubber/Drybed system. Using the 99.9% control efficiency demonstrated during the January 23, 2003 test, the resulting annual emissions from the aeration room total approximately 11 pounds. Backvent process emissions, representing approximately 1% of total ethylene oxide used (2,650 pounds) are not treated and exhaust to atmosphere resulting in 2,650 pounds. In total, the facility had an estimated 2,662 pounds (1.33 tons) of ethylene oxide point source emissions during the 12 month period ending December 31, 2016.

The Willowbrook II facility used approximately 127,543 pounds of ethylene oxide during the 12 month period ending December 31, 2016. Approximately 95% of that amount (121,166 pounds) is emitted through sterilization chamber vents (via vacuum pumps) to the AAT Scrubber/Drybed system. Using the 99.94% control efficiency obtained from the December 13th test, the resulting emissions are calculated to be approximately 73 pounds per year. Approximately 4% of the ethylene oxide used by the facility (5,102 pounds) represents process emissions from the facility's aeration room which is also treated by the AAT Scrubber/Drybed system. Using the 99.96% control efficiency demonstrated during the December 13th test, the resulting annual emissions from the aeration room total approximately 2 pounds. Backvent process emissions, representing approximately 1% of total ethylene oxide used (1,275 pounds) are not treated and exhaust to atmosphere resulting in 1,275 pounds. In total, the facility had an estimated 1,350 pounds (0.68 tons) of ethylene oxide point source emissions during the 12 month period ending December 31, 2016.

Analysis Demonstrating Whether Source is a Major Source - Section 63.9(h)(E)

Based on the above emissions, the facility emits less than 10 tons/year of ethylene oxide and is an area source.

Description of Air Pollution Control Device & Control Efficiency for Facility's Emission Points – Section 63.9(h)(F)

For Willowbrook I, a Deoxx Acid Wet Scrubber system demonstrated to have a control efficiency of 99.9996% treats emissions from the facility's sterilization chamber vents (i.e., vacuum pump emissions). Process emissions from the facility's aeration rooms are controlled using an AAT Acid Wet Scrubber/Drybed system. The control efficiency of this device during annual testing on January 23, 2003 was 99.9%.

For Willowbrook II, an AAT Acid Wet Scrubber system demonstrated to have a control efficiency of 99.94% treats emissions from the facility's sterilization chamber vents (i.e., vacuum pump emissions). Process emissions from the facility's aeration rooms are also controlled using the AAT Acid Wet Scrubber/Drybed system. The control efficiency of this device during annual testing was 99.96%.

Statement by Owner as to Whether the Facility Has Complied with the Relevant Standard – Section 63.9(h)(G)

To the best of our knowledge, our Willowbrook, IL facility has operated in compliance with the applicable standards in 40 CFR Part 63, Subpart O.



Certification Statement:

To the best of the undersigned's knowledge, information and belief formed after reasonable inquiry, the information submitted in this notification of compliance status for Sterigenics' Willowbrook, IL facility is true, accurate, and complete.

KATHLEEN HOFFMAN

Signature

13-Feb-2017

Date

Kathleen Hoffman

Printed Name

If you should need further information, please contact me at (630) 928-1771 or kwagner@sterigenics.com

Sincerely,

A handwritten signature in black ink, appearing to read "Kevin Wagner".

Kevin Wagner
Director, EH&S

cc: USEPA Region 5, Air Branch
USEPA (AR-17J)
Air & Radiation Division
77 West Jackson Blvd.
Chicago, Illinois 60604

Kathy Hoffman, Sterigenics—Sr. Vice-President EH&S and Technical Services
Juan Segovia, Sterigenics—Vice-President Operations
Shawn Pollino, Sterigenics—Willowbrook General Manager

**REPORT OF
AIR POLLUTION SOURCE TESTING
OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM
OPERATED BY STERIGENICS, INC.
IN WILLOWBROOK, ILLINOIS
ON DECEMBER 12, 2016**

Submitted to:

**ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 North Grand Avenue East
Springfield, Illinois 62794**

Submitted by:

**STERIGENICS US, LLC.
2015 Spring Road
Oak Brook, Illinois 60523**

I.D. Number 043110AAC

Prepared by:

**ECSI, INC.
PO Box 848
San Clemente, California 92674-0848**

January 20, 2017

ECSI

CONTACT SUMMARY

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TEST DATE

Monday, December 12, 2016

REGULATORY AGENCY

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1.0 INTRODUCTION

On Monday, December 12, 2016, ECSi, Inc. performed air pollution source testing of an ethylene oxide (EtO) emission-control device operated by Sterigenics, Inc. at their Willowbrook I facility, located at 7775 S. Quincy Street. The device tested was the Chemrox DEOXX packed tower scrubber emission-control system, which is used to control emissions from fourteen sterilizer vacuum pumps. The purpose of the testing program was to demonstrate continued compliance with the conditions established in the Air Quality Permit granted to Sterigenics by the Illinois Environmental Protection Agency (IEPA).

2.0 EQUIPMENT

The EtO gas-sterilization system is comprised of fourteen commercial sterilizers, which are discharged through liquid-ring vacuum pumps to a Chemrox DEOXX packed tower scrubber emission-control system. The gas-sterilization and emission-control equipment tested consists of the following:

- Fourteen Gas Sterilizers, each comprised of a steam-heated sterilization chamber, a recirculating vacuum pump chamber evacuation system, a backvent valve, and a fugitive emissions exhaust hood;

Sterilizer vacuum pump emissions are controlled by:

- One Chemrox DEOXX packed tower chemical scrubber, equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank.

3.0 TESTING

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the packed tower scrubber during the first chamber evacuation of the sterilizer exhaust phase of one of the fourteen sterilizers. A total of three exhaust-phase test runs were performed.

During the first chamber evacuation of the exhaust phase, EtO emissions to the inlet of the packed tower scrubber were determined using the Ideal Gas Law and the chamber conditions at the beginning and at the end of the first chamber evacuation. During the first chamber evacuation of the exhaust phase, EtO emissions from the outlet of the packed tower scrubber were determined using direct source sample injection into the GC.

All exhaust phase testing was conducted during normal process load conditions, but with an empty sterilization chamber to facilitate inlet mass calculation and the performance of multiple test runs. The testing program was conducted in accordance with the procedures outlined in the following sections.

4.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at Sterigenics was tested to demonstrate compliance with EPA requirements, as specified in the IEPA Air Quality Permit. The following requirements must be met:

- The sterilizer exhaust phase (post exposure vacuum pulses) emissions must be vented to control equipment with an EtO emission-reduction efficiency of at least 99 % by weight.

Testing is required to demonstrate compliance with these requirements. Source testing of the packed tower scrubber emission-control device is required initially, and may be required periodically thereafter.

5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the packed tower scrubber during the first chamber evacuation of the sterilizer exhaust phase of one of the fourteen sterilizers. A total of three exhaust-phase test runs were performed.

Exhaust phase testing with one sterilizer discharging to the scrubber at a time represents worst-case conditions for demonstration of control efficiency compliance. At this lower inlet loading, the scrubber must perform at its maximum efficiency to achieve outlet EtO concentrations low enough to demonstrate compliance. One of the larger sterilizers was tested for each of the test runs to provide a realistic operational scenario.

During the first chamber evacuation of the exhaust phase, EtO emissions to the inlet of the packed tower scrubber were determined using the Ideal Gas Law and the chamber conditions at the beginning and at the end of the first chamber evacuation. During the first chamber evacuation of the exhaust phase, EtO emissions from the outlet of the packed tower scrubber were determined using direct source sample injection into the GC.

All exhaust phase testing was conducted during normal process load conditions, but with an empty sterilization chamber to facilitate inlet mass calculation and the performance of multiple test runs. The testing program was conducted in accordance with the procedures outlined in the following sections.

Operation and documentation of process conditions was performed by personnel from Sterigenics, Inc. using existing monitoring instruments installed by the manufacturer on the equipment to be tested. In accordance with the procedures established in USEPA CFR40, Part 63, Subpart O, scrubber liquor level was recorded.

5.2 VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the outlet of the scrubber was determined by 40 CFR 60, Appendix A, Method 2, using an s-type pitot tube and an inclined-oil manometer. Sampling ports were located in accordance with 40

CFR 60, Appendix A, Method 1. The test ports were located far enough from any flow disturbances to permit accurate flow measurement.

Temperature measurements were obtained from a type K thermocouple and thermometer attached to the sampling probe. Exhaust gas composition was assumed to be air and small amounts of water vapor. Water vapor was negligible and, based on previous test data, a value of 2 percent was used for flow calculations.

5.3 CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

During the first chamber evacuation of the sterilizer exhaust phase, the mass emissions of EtO vented to the inlet of the scrubber were determined using the procedures outlined in CFR40, Part 63.365. This method allows the determination of the mass of EtO vented to the inlet of the scrubber through calculations based on the Ideal Gas Law and using the conditions (pressure, temperature, volume) of the sterilization chamber immediately after it has been charged with sterilant gas, and upon conclusion of the first chamber evacuation of the exhaust phase.

The mass of EtO vented to the inlet of the scrubber during the first chamber evacuation of the exhaust phase was determined by calculating the mass of EtO present in the chamber after the first chamber evacuation and subtracting it from the mass of EtO present in the chamber after it had been charged with sterilant gas. The mass of EtO present in the chamber was calculated using Equation 1, shown below in Section 5.9.

During the first chamber evacuation of the sterilizer exhaust phase, EtO emissions from the outlet were determined using direct source sample injection into the GC. The mass of EtO emitted from the outlet was determined using Equation 2, shown below in Section 5.9. Mass-mass control-efficiency of EtO during the sterilizer exhaust phase was calculated by comparing the mass of EtO vented to the system inlet to the mass of EtO vented from the system outlet.

During the sterilization chamber exhaust phase, vented gas was analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A photoionization detector (PID) was used to quantify low-level EtO emissions at the packed tower scrubber outlet.

5.4 SAMPLE TRANSPORT

Source gas was pumped to the GC at approximately 500-1000 cubic centimeters per minute (cc/min) from the sampling ports through two lengths of Teflon® sample line, each with a nominal volume of approximately 75 cubic centimeters (cc) and an outer diameter of 0.25 inch. At the outlet of the scrubber the sampling ports were located in the exhaust stack.

5.5 GC INJECTION

Source-gas samples were then injected into the GC which was equipped with two heated sampling loops, each containing a volume of approximately 2cc and maintained at 100 degrees Celsius (C). Injections occurred at approximately one-minute intervals during the sterilization chamber exhaust phase. Helium was the carrier gas for the PID.

5.6 GC CONDITIONS

The packed columns for the GC were both operated at 90 degrees C. The columns were stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B.

Any unused sample gas was vented from the GC system back to the inlet of the scrubber.

5.7 CALIBRATION STANDARDS

The PID was calibrated for low-range ppmv level analyses using gas proportions similar to the following:

- 1) 100 ppmv EtO, balance nitrogen
- 2) 50 ppmv EtO, balance nitrogen (audit gas)
- 3) 10 ppmv EtO, balance nitrogen
- 4) 1 ppmv EtO, balance nitrogen

Each of these calibration standards was in a separate, certified manufacturer's cylinder. Copies of the calibration gas laboratory certificates are attached as Appendix F.

5.8 SAMPLING DURATION

Exhaust phase EtO measurements were taken for the entire duration of the first chamber evacuation, which was approximately 10-20 minutes. This encompassed a total sampling duration of approximately 10-20 minutes for each exhaust phase test run.

5.9 CONTROL-EFFICIENCY/MASS-EMISSIONS CALCULATIONS

The following equation was used to calculate mass of EtO discharged to the inlet of the emission-control system during the first chamber evacuation of the sterilizer exhaust phase:

EQUATION 1:

$$W_c = W_{ci} - W_{cf}$$

Where:

W_c = Weight of EtO discharged from the sterilization chamber to the emission-control system during the first chamber evacuation, pounds

$$W_{ci} = (mw)(p)(P)(V)/(R)(T)$$

(and W_{cf})

Where:

W_{ci} = Weight of EtO present in the sterilization chamber before the first chamber evacuation, pounds

W_{cf} = Weight of EtO present in the sterilization chamber after the first chamber evacuation, pounds

MW = Molecular weight of EtO, 44.05 lb/mol

p = Percent of EtO in chamber
= W_s/W_i

Where:

W_s = Scale-measured weight of EtO charged into sterilization chamber

W_i = Calculated weight of EtO charged into sterilization chamber (@ 100%)

P = Sterilization chamber pressure (after charging/at the end of the 1st evac), psia

V = Sterilization chamber volume, ft³

R = Gas constant, 10.73 psia·ft³/mol·°R

T = Sterilization chamber temperature (after charging/at the end of the 1st evac), °R

Note: Standard conditions are 68°F and 1 atm.

Mass emissions of EtO during the exhaust phase were calculated using the following equation:

EQUATION 2:

$$\text{MassRate} = (\text{VolFlow})(\text{MolWt})(\text{ppmv EtO}/10^6)/(\text{MolVol})$$

Where:

MassRate = EtO mass flow rate, pounds per minute

VolFlow = Corrected volumetric flow rate, standard cubic feet per minute at 68 degrees F

MolWt = 44.05 pounds EtO per pound mole

ppmv EtO = EtO concentration, parts per million by volume

10^6 = Conversion factor, ppmv per "cubic foot per cubic foot"

MolVol = 385.32 cubic feet per pound mole at one atmosphere and 68 degrees F

Results of the control-efficiency testing are presented in Section 8.0 and in Table 1.

6.0 TEST SCENARIO

During exhaust phase testing, each sterilizer was tested during normal process load conditions, but with an empty sterilization chamber to facilitate the performance of multiple test runs. A total of three exhaust-phase test runs were performed to verify the performance of the emission-control device. Testing was conducted with an effort to offer minimal disruption to the Sterigenics production schedule. The testing schedule was as follows:

- 1) Testing equipment was set up and calibrated.
- 2) An empty-chamber cycle was started in one of the larger sterilizers. This sterilizer was isolated for test use and designated as a test chamber.
- 3) Exhaust Phase Test Run #1 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the Chemrox scrubber.
- 4) An empty-chamber cycle was started in another of the larger sterilizers. This sterilizer was isolated for test use and designated as a test chamber.
- 5) Exhaust Phase Test Run #2 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the Chemrox scrubber.
- 6) An empty-chamber cycle was started in another of the larger sterilizers. This sterilizer was isolated for test use and designated as a test chamber.
- 7) Exhaust Phase Test Run #3 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the Chemrox scrubber.
- 8) Post calibration check was performed, testing equipment was packed.

7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system was leak checked at a vacuum of 15 inches of mercury. The sampling system was considered leak free when the flow indicated by the rotameters fell to zero.

At the beginning of the test, a system blank was analyzed to ensure that the sampling system was free of EtO. Ambient air was introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also provided a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device, and due to the destruction of EtO by the emission-control device which produces carbon dioxide and water vapor. This chromatogram, designated AMB, is included with the calibration data in Appendix A.

7.2 CALIBRATION PROCEDURES

The GC system was calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a point-to-point calibration curve was constructed for each detector. A gas cylinder of similar composition as the calibration gases, but certified by a separate supplier, was used to verify calibration gas composition and GC performance.

All calibration gases and support gases used were of the highest purity and quality available. A copy of the laboratory certification for each calibration gas is attached as Appendix F.

8.0 TEST RESULTS

The Ceilcote scrubber demonstrated an EtO control efficiency of 99.9996 percent. In accordance with EPA requirements, as specified in the IEPA Air Quality Permit, this control equipment must have an EtO control efficiency of 99 percent or more during the sterilizer exhaust phase (vacuum pump emissions). The emission-control device met this requirement.

The test results are summarized in Table 1. These tables include results for EtO control efficiency of the emission-control device. Chromatograms and chromatographic supporting data are attached as Appendices A through D. Copies of field data and calculation worksheets are attached as Appendix E.

TABLES

TABLE 1
ETHYLENE OXIDE CONTROL EFFICIENCY
OF A CHEMROX DEOXX PACKED TOWER SCRUBBER EMISSION CONTROL DEVICE
OPERATED BY STERIGENICS, INC.
IN WILLOWBROOK, ILLINOIS (PLANT 1)
DECEMBER 12, 2016

Run #	Stack Flow (dscfm) (2)	Average Outlet Conc. (ppm) (1)	Outlet EtO Mass Flow (lbs/min) (3)	Minutes/ Cycle	Outlet EtO Mass Emissions (lbs)	Inlet EtO Mass Emissions (lbs)	EtO Control Efficiency (%)
#1	63.8	0.3021	0.0000022	19	0.0000419	47.4	99.9999
#2	65.4	1.325	0.0000099	17	0.0001683	50.8	99.9997
#3	140	0.010	0.0000002	11	0.0000019	39.3	100.0000
Average EtO Control Efficiency:							99.9999
Required EtO Control Efficiency:							99

Notes: (1) - PPM = parts per million by volume
(2) - DSCFM = dry standard cubic feet per minute
(3) - LBS/MIN = EtO emissions, pounds per minute
(4) - Testing was performed with the scrubber liquor level at 181 inches.

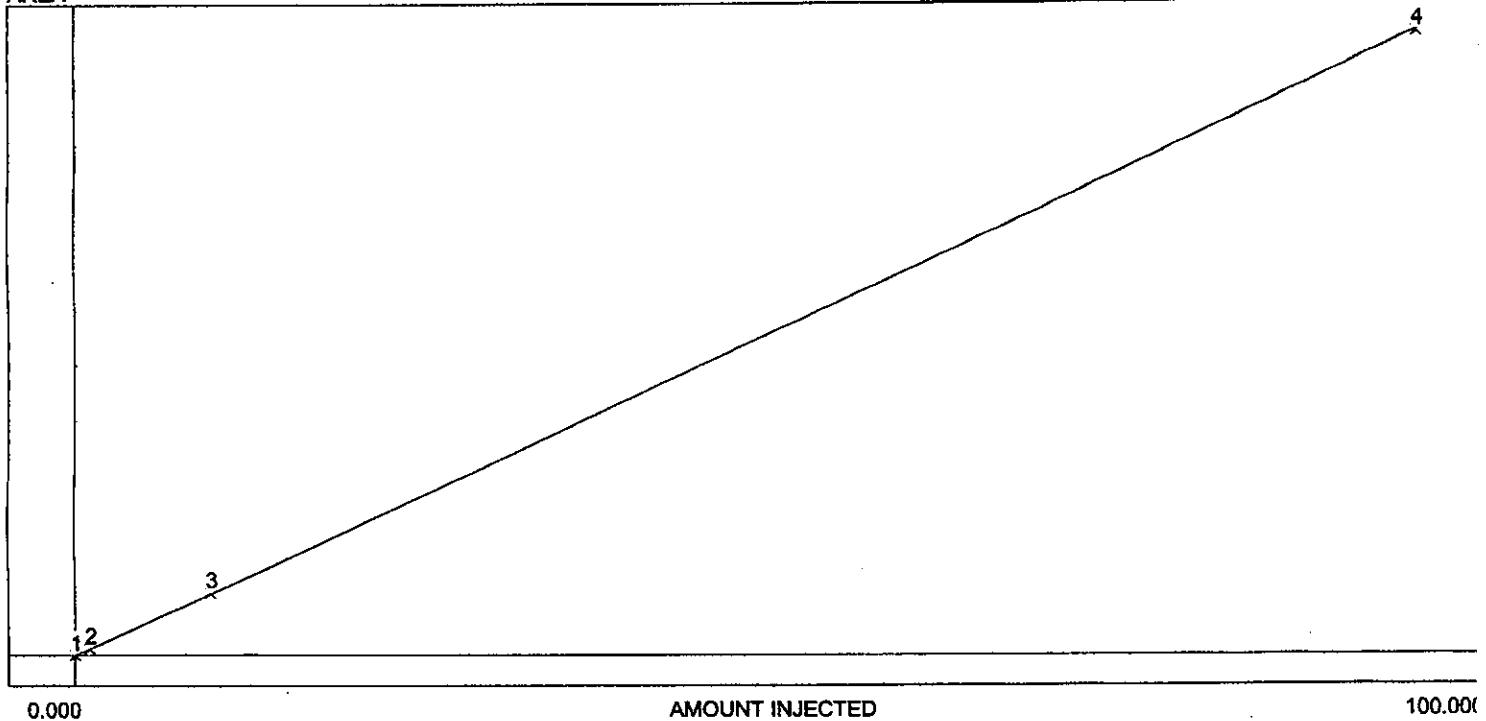
APPENDICES

APPENDIX A

Calibration Data

ak	Name	Start	End	Calibration	Int.Std	Units
	Dead Vol / Air	0.000	0.350		0.000	
	Ambient H2O	0.350	0.500		0.000	
	Ethylene Oxide	0.500	0.600	C:\peak359\1Ster	0.00016	ppm
	Acetaldehyde	0.600	0.800		0.000	
	CO2	0.800	1.000		0.000	

AREA



slope of curve: 0.43

xis intercept: 0.00

earity: 1.00

nber of levels: 4

'rel SD of CF's: 0.2/66.7

0.4316X

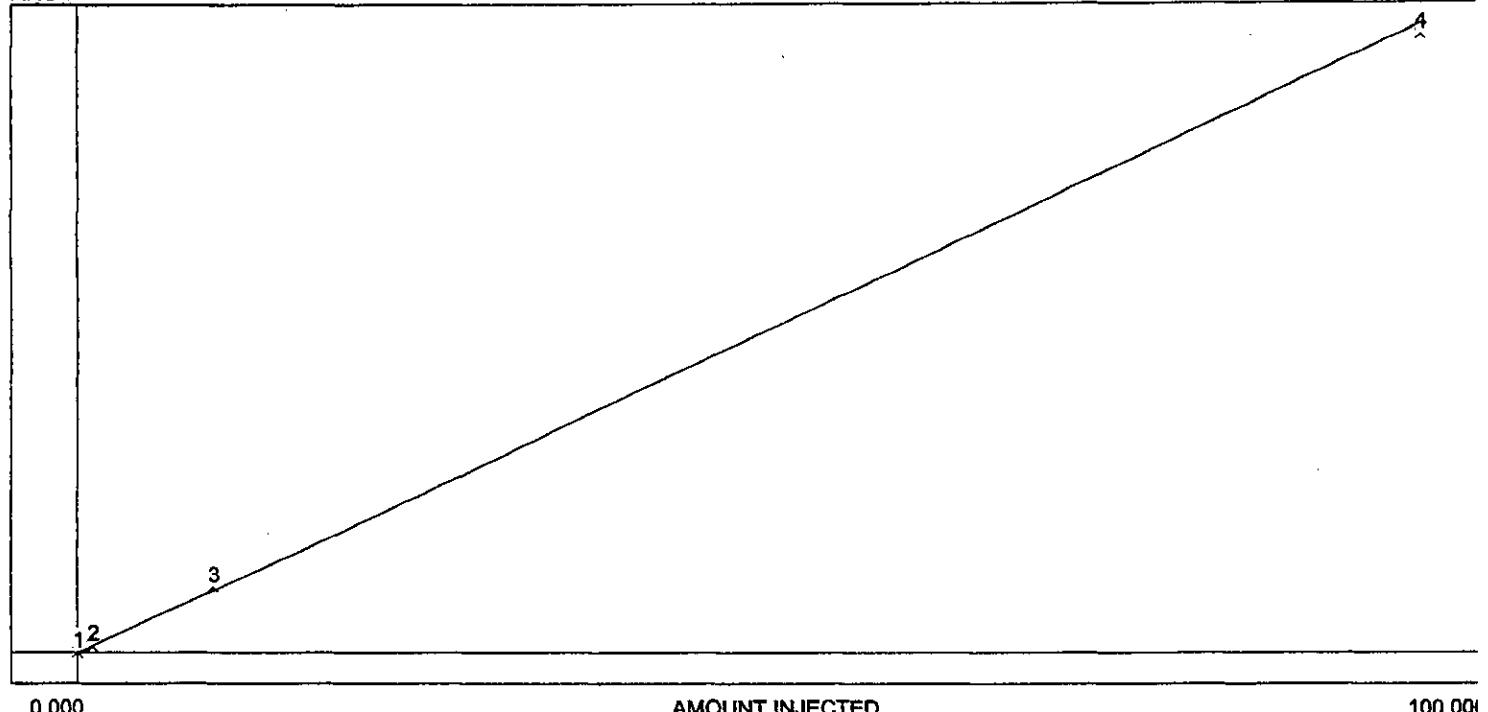
1.0000

t calibrated: Fri Dec 02 08:01:11 2016

Area/Ht.	Amount	CF	Current	Previous #1	Previous #2
0.000	0.000	0.000	0.000	N/A	N/A
0.470	1.100	0.427	0.470	N/A	N/A
4.420	10.100	0.438	4.420	N/A	N/A
43.000	100.000	0.430	43.000	N/A	N/A

rk	Name	Start	End	Calibration	Int.Std	Units
	Dead Vol / Air	0.000	0.350		0.000	
	Ambient H2O	0.350	0.500		0.000	
	Ethylene Oxide	0.500	0.600	C:\peak359\2Ster	0.000	16.ppm
	Acetaldehyde	0.600	0.800		0.000	
	CO2	0.800	1.000		0.000	

AREA



slope of curve: 1.82

x axis intercept: 0.00

earity: 1.00

nber of levels: 4

/rel SD of CF's: 0.9/67.0

1.8223X

0.9999

it calibrated: Fri Dec 02 08:00:23 2016

Area/ht.	Amount	CF	Current	Previous #1	Previous #2
0.000	0.000	0.000	0.000	N/A	N/A
1.910	1.100	1.736	1.910	N/A	N/A
19.600	10.100	1.941	19.600	N/A	N/A
179.000	100.000	1.790	179.000	N/A	N/A

Client: Sterigenics - Willowbrook 1

Client ID: PreCal

Analysis date: 12/12/2016 14:15:28

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

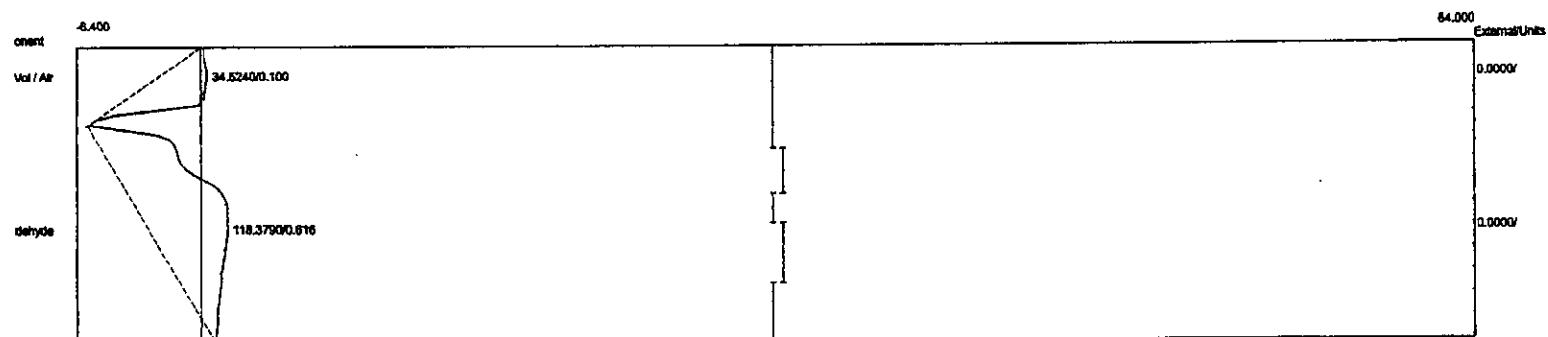
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E.CHR (c:\peak359)

Sample: Ambient Background

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.100	34.5240	0.0000
aldehyde	0.616	118.3790	0.0000

	152.9030	0.0000
--	----------	--------

APPENDIX B

Run#1 Chromatograms

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:32:37

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

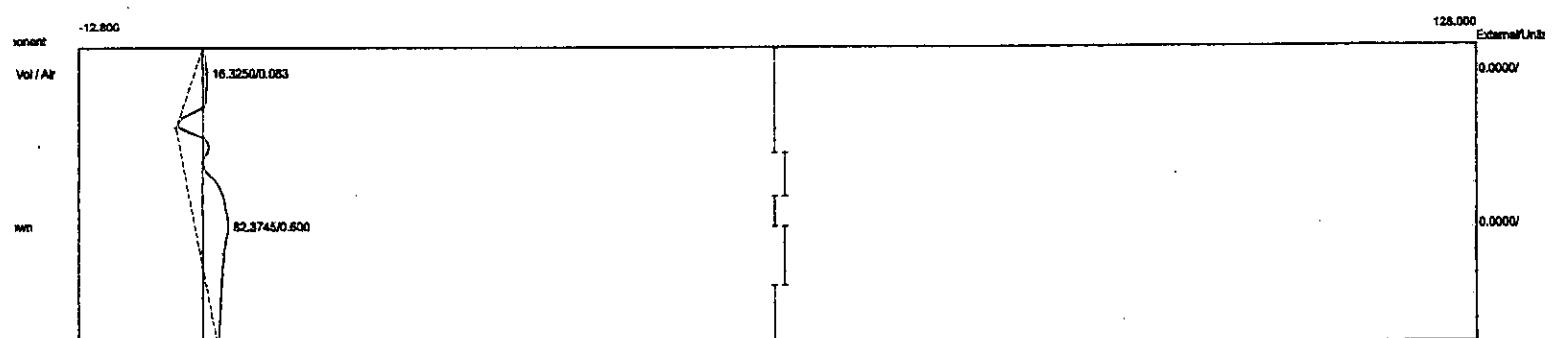
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E01.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	16.3250	0.0000	
--------------	-------	---------	--------	--

	16.3250	0.0000		
--	---------	--------	--	--

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:34:05

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

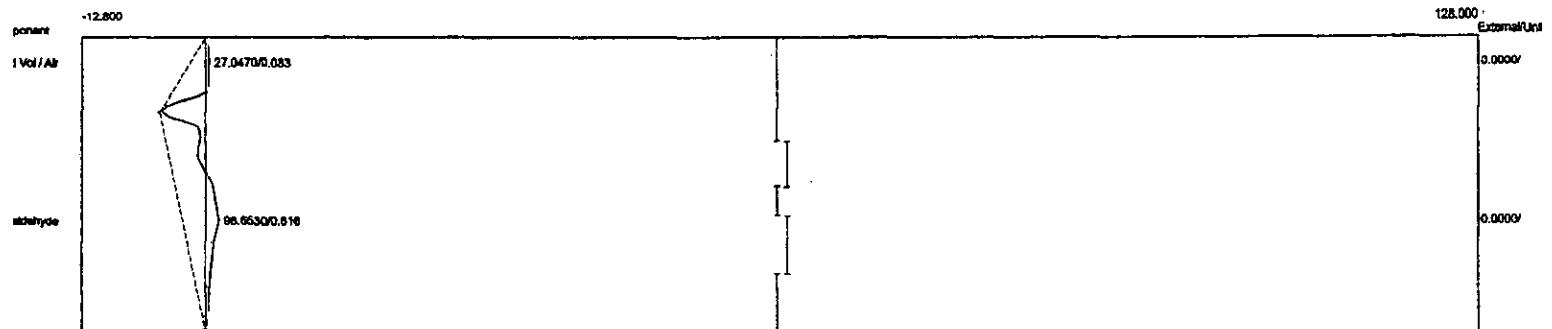
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E02.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

air Vol / Air	0.083	27.0470	0.0000	
formaldehyde	0.616	98.6630	0.0000	

	125.7000	0.0000	
--	----------	--------	--

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:35:21

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

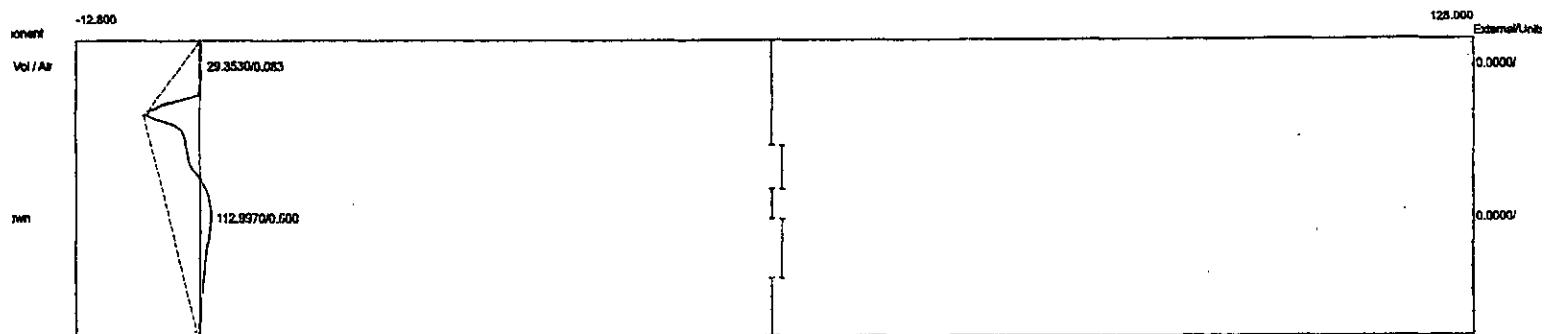
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E03.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer

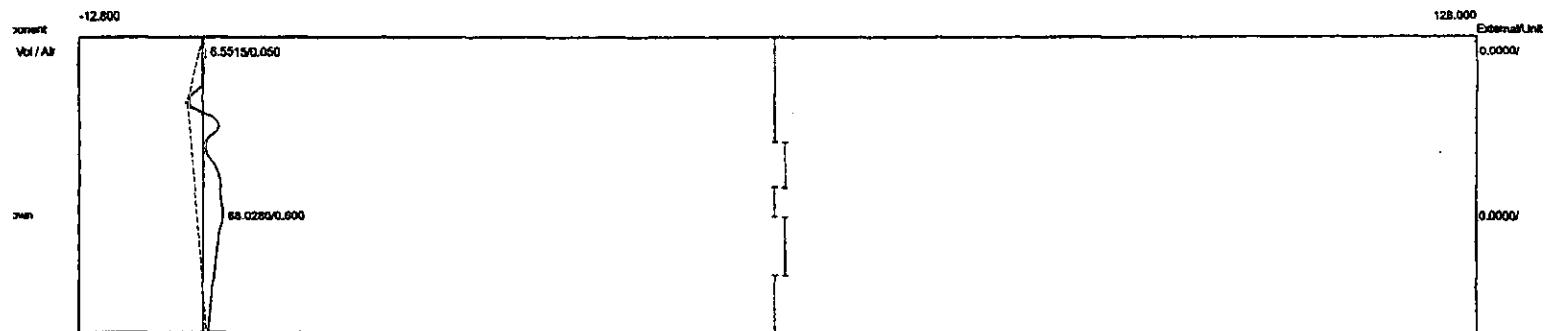


Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	29.3530	0.0000	
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	29.3530	0.0000	
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Client: Sterigenics - Willowbrook 1
Client ID: Run#1Exh
Analysis date: 12/12/2016 14:36:33
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: C:\peak359\eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2016-1E04.CHR (c:\peak359)
Sample: DEOXX Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.050	6.5515	0.0000	
		6.5515	0.0000	

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:37:45

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

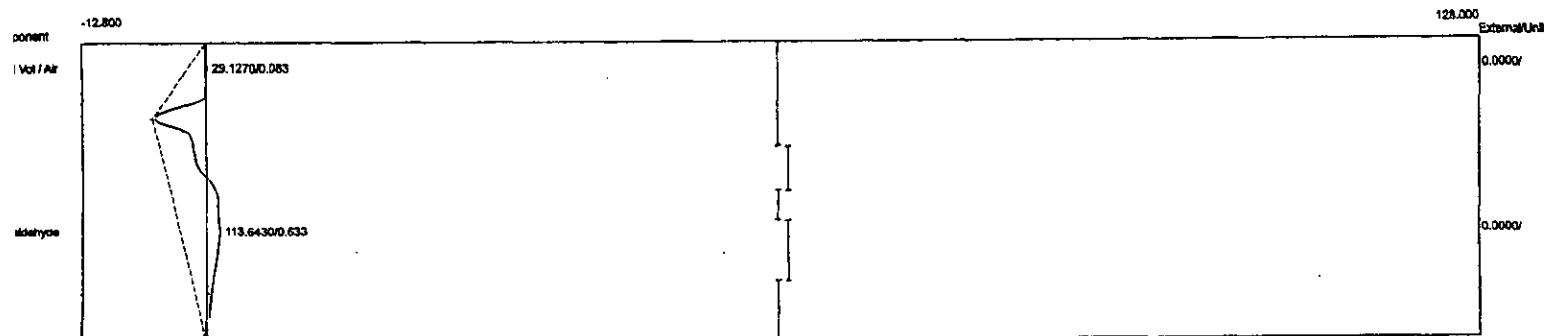
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E05.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Formal Vol / Air	0.083	29.1270	0.0000	
Acetaldehyde	0.633	113.6430	0.0000	

	142.7700	0.0000	
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Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:39:05

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

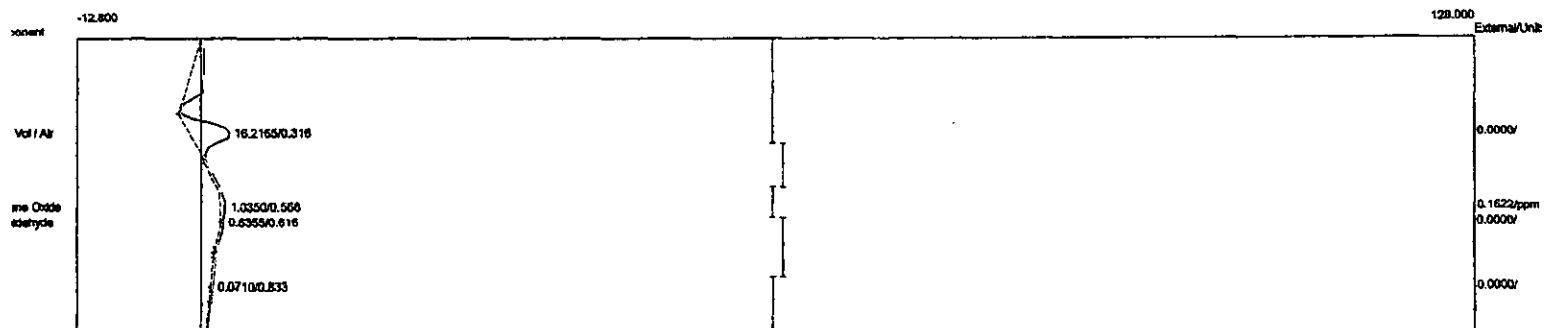
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E06.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.316	16.2165	0.0000	
Ethylene Oxide	0.566	1.0350	0.1622	ppm
Formaldehyde	0.616	0.6355	0.0000	
i2	0.833	0.0710	0.0000	
		17.9580	0.1622	

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:40:18

Method: Direct Injection

Description: CHANNEL 2 - PID.

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

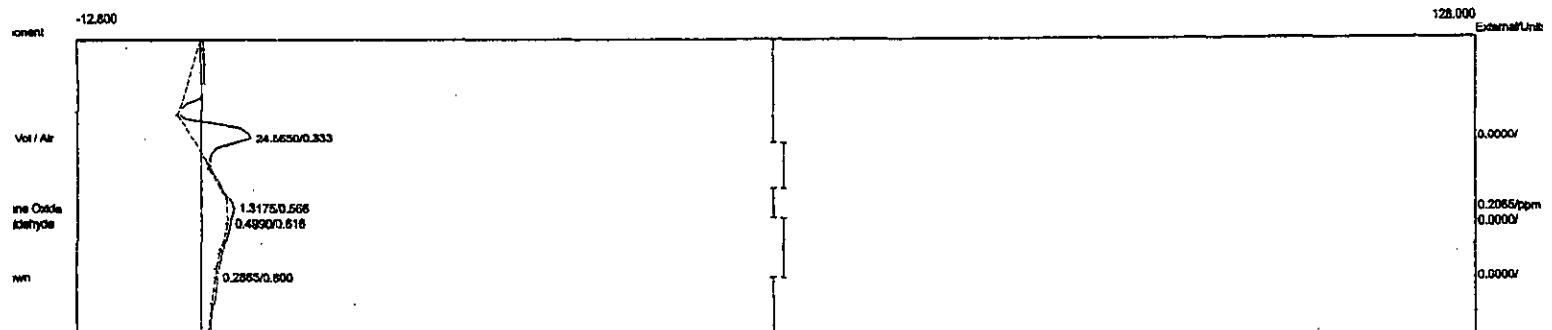
Temp. prog: C:\peak359\eto-100.tern

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E07.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.333	24.6650	0.0000	
Ethylene Oxide	0.566	1.3175	0.2065	ppm
Etaldehyde	0.616	0.4990	0.0000	

26.4815 0.2065

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:41:35

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

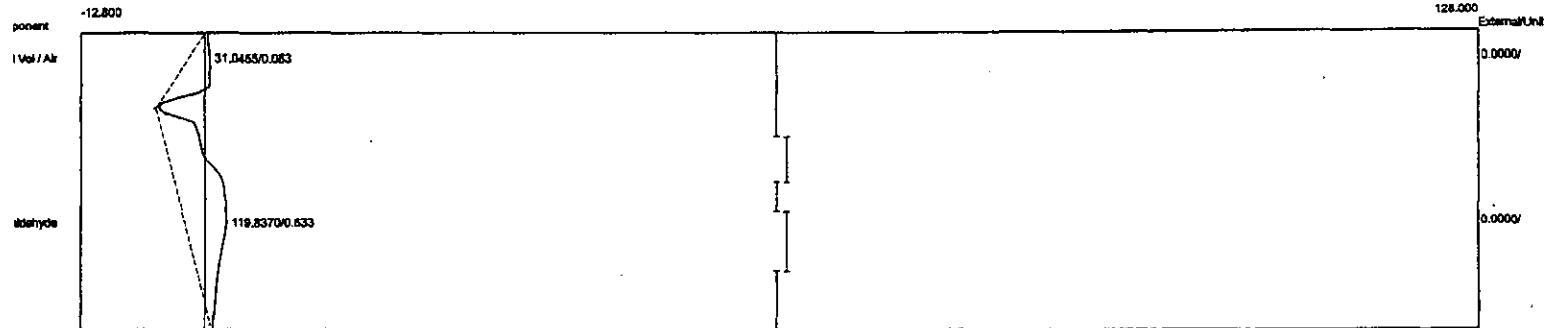
Temp, prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E08.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	31.0455	0.0000	
etaldehyde	0.633	119.8370	0.0000	

	150.8825	0.0000	
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Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:42:48

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

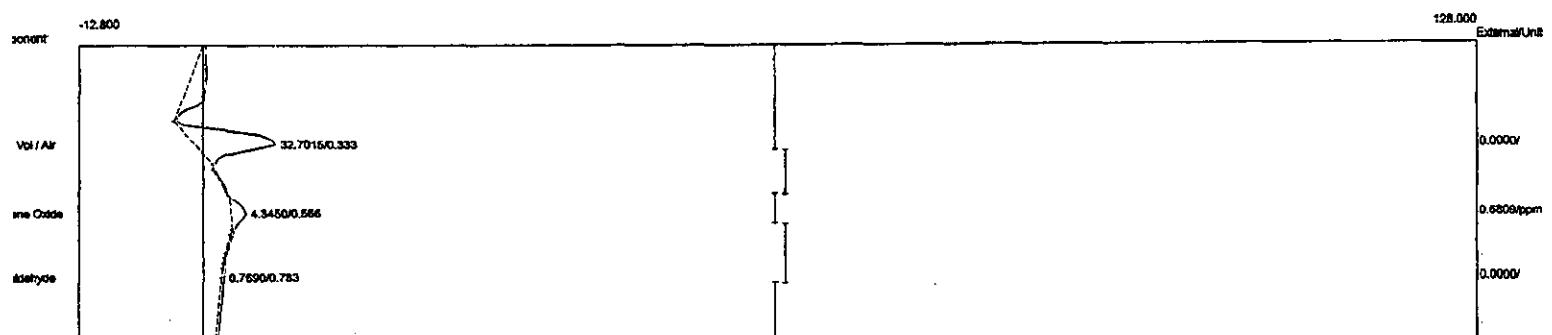
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E09.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.333	32.7015	0.0000	
Ethylene Oxide	0.566	4.3450	0.6809	ppm
Acetaldehyde	0.783	0.7690	0.0000	
		37.8155	0.6809	

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

analysis date: 12/12/2016 14:44:00

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPac B

Carrier: HELIUM

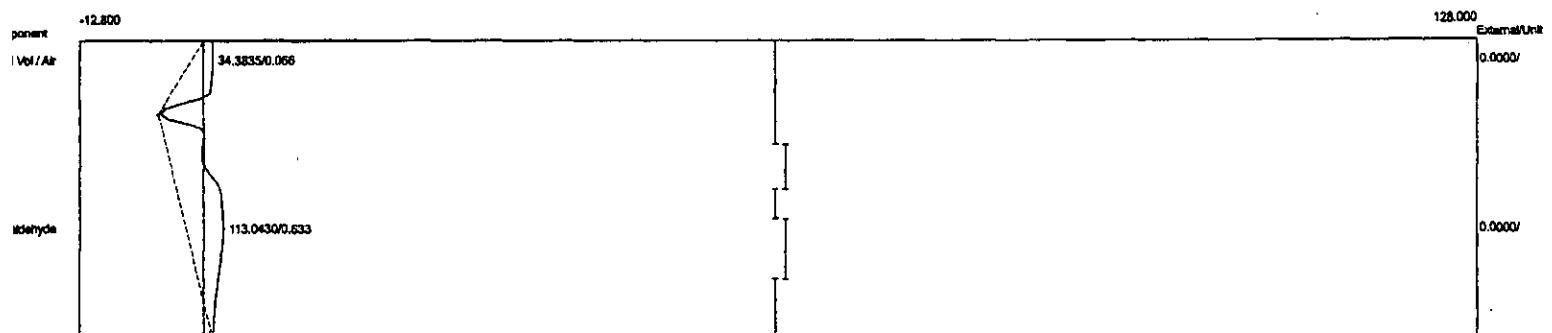
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E10.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.066	34.3835	0.0000	
et aldehyde	0.633	113.0430	0.0000	

	147.4265	0.0000	
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Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:45:13

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

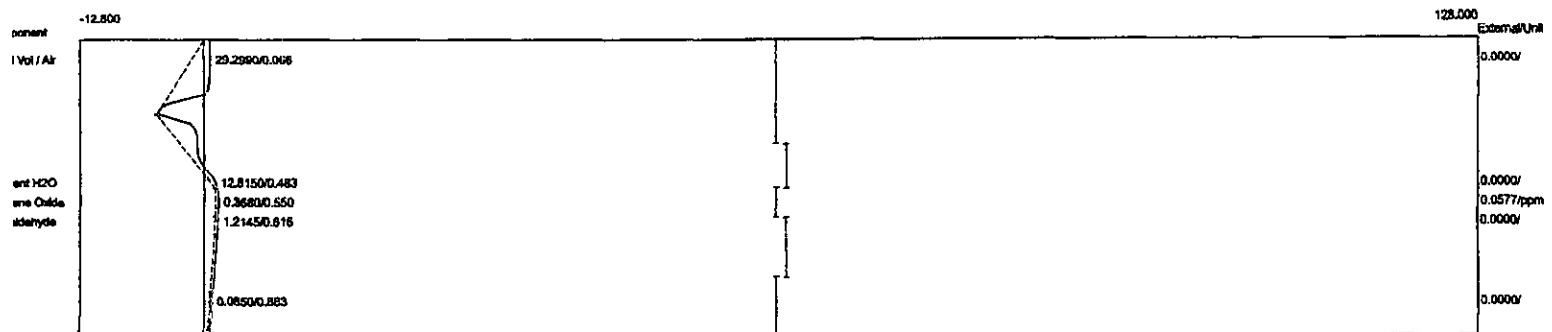
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E11.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.066	29.2990	0.0000	
ambient H2O	0.483	12.8150	0.0000	
ethylene Oxide	0.550	0.3680	0.0577	ppm
etaldehyde	0.616	1.2145	0.0000	
CO ₂	0.883	0.0850	0.0000	
		43.7815	0.0577	

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:46:44

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

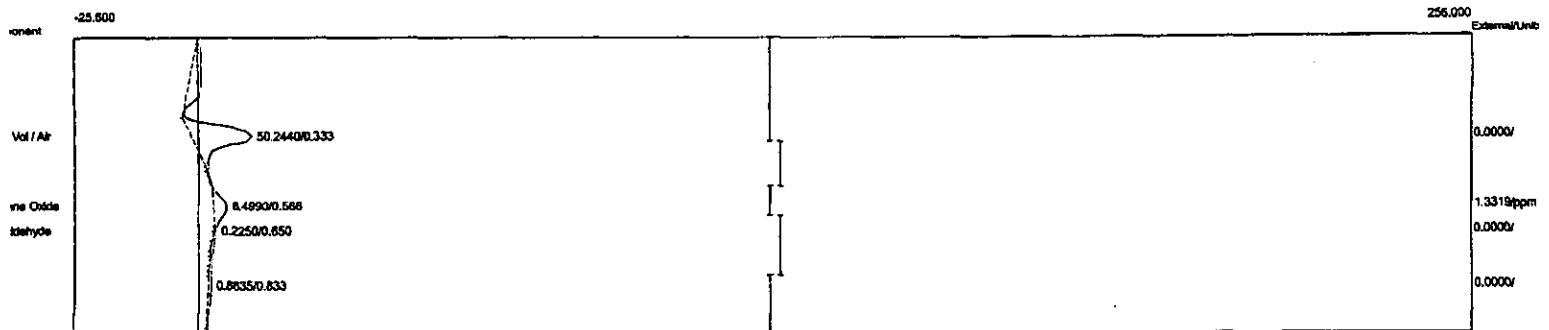
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E12.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.333	50.2440	0.0000	
Ethylene Oxide	0.566	8.4990	1.3319 ppm	
Formaldehyde	0.650	0.2250	0.0000	
I2	0.833	0.8635	0.0000	
		59.8315	1.3319	

Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:48:15

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

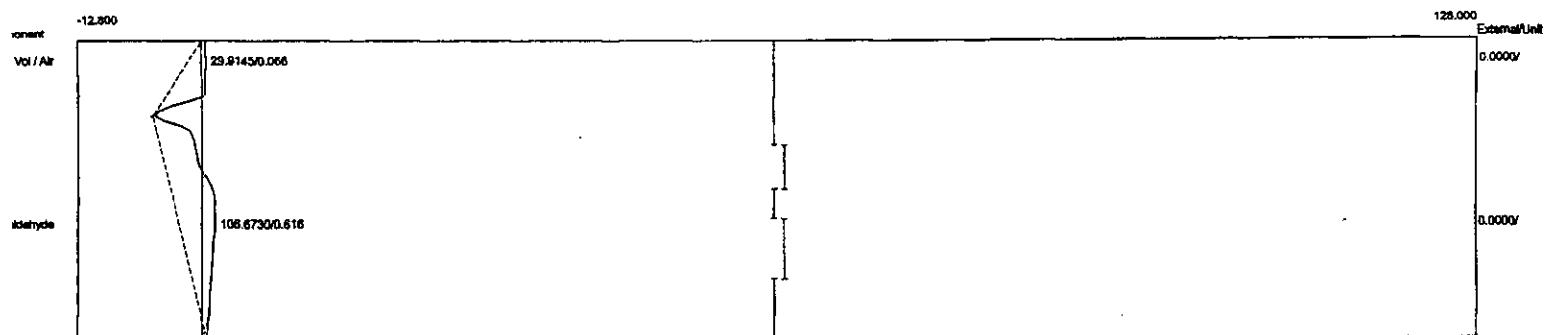
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E13.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.066	29.9145	0.0000	
Formaldehyde	0.616	106.6730	0.0000	

	136.5875	0.0000	
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Client: Sterigenics - Willowbrook 1

Client ID: Run#1Exh

Analysis date: 12/12/2016 14:49:35

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

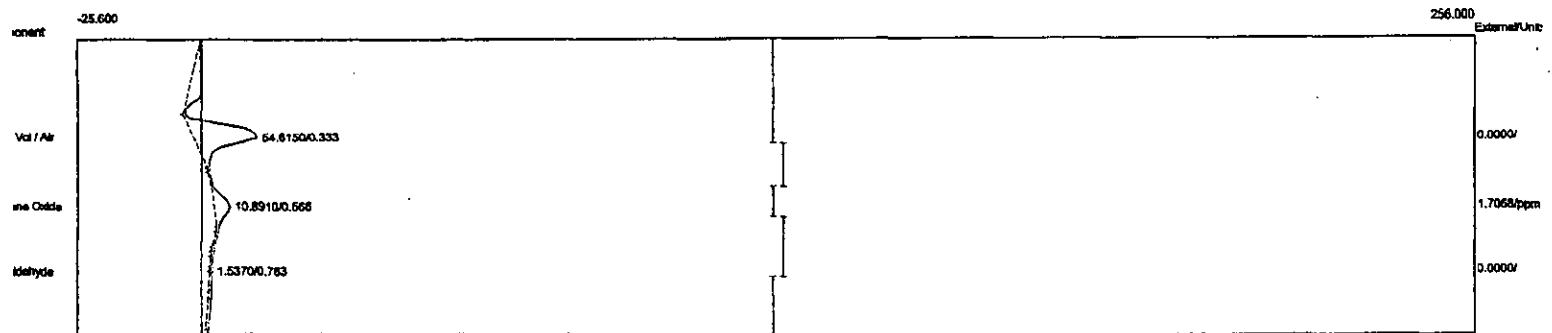
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-1E14.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



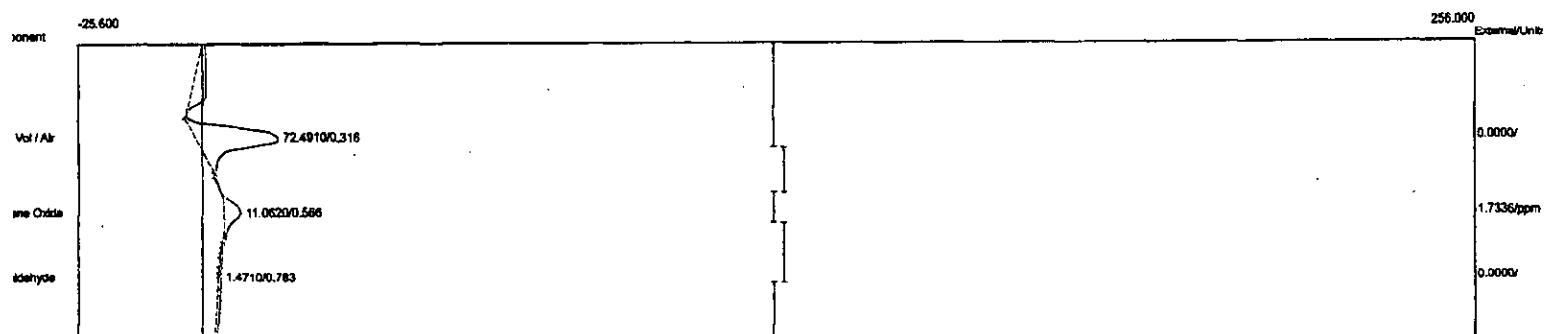
Component	Retention	Area	External Units
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Vol / Air	0.333	54.6150	0.0000
Ethylene Oxide	0.566	10.8910	1.7068 ppm
Formaldehyde	0.783	1.5370	0.0000
		67.0430	1.7068

APPENDIX C

Run#2 Chromatograms

Client: Sterigenics - Willowbrook 1
Client ID: Run#2Exh
Analysis date: 12/12/2016 15:01:53
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: C:\peak359\eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2016-2E01.CHR (c:\peak359)
Sample: DEOXX Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.316	72.4910	0.0000	
Ethylene Oxide	0.566	11.0620	1.7336	ppm
Formaldehyde	0.783	1.4710	0.0000	
		85.0240	1.7336	

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:03:31

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

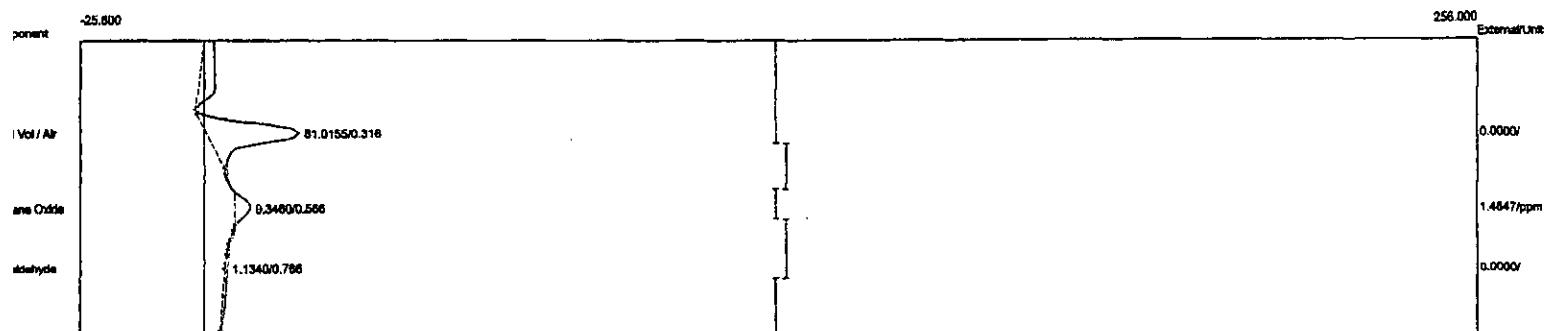
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E02.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.316	81.0155	0.0000	
Ethylene Oxide	0.566	9.3460	1.4647 ppm	
Formaldehyde	0.766	1.1340	0.0000	
	91.4955		1.4647	

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:04:46

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

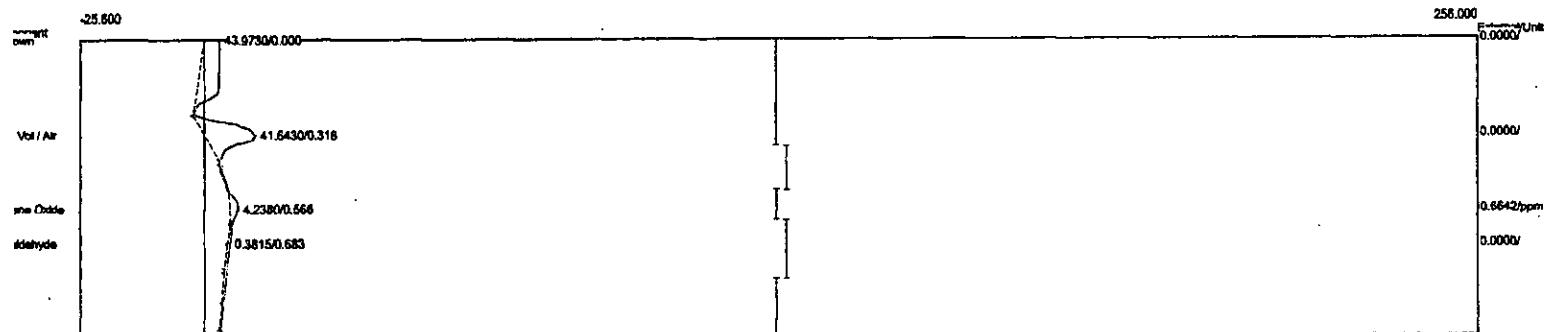
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E03.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.316	41.6430	0.0000	
Ethylene Oxide	0.566	4.2380	0.6642	ppm
Formaldehyde	0.683	0.3815	0.0000	
		46.2625	0.6642	

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:06:08

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

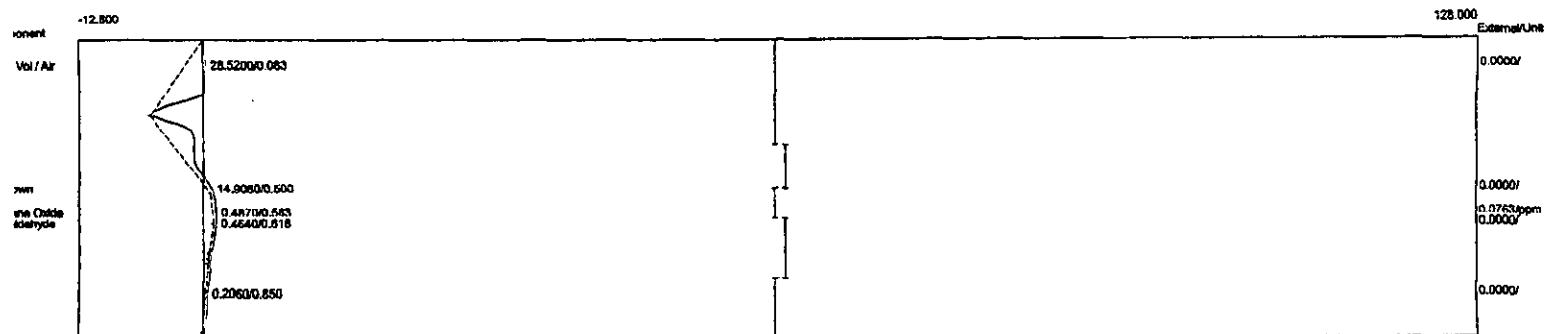
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E04.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	28.5200	0.0000	
Ethylene Oxide	0.583	0.4870	0.0763	ppm
Formaldehyde	0.616	0.4640	0.0000	
I2	0.850	0.2060	0.0000	
		29.6770	0.0763	

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:07:25

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

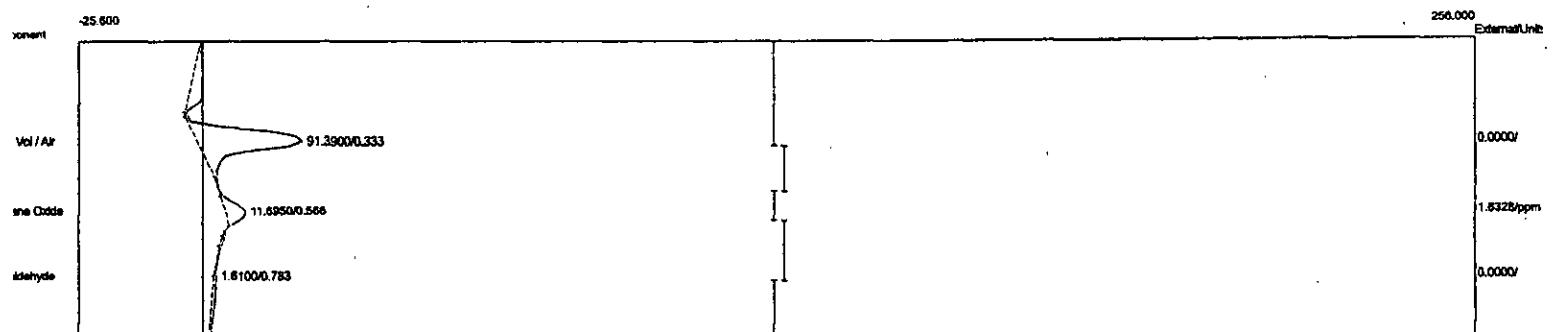
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E05.CHR (c:\peak359)

Sample: DEOXX Outlet

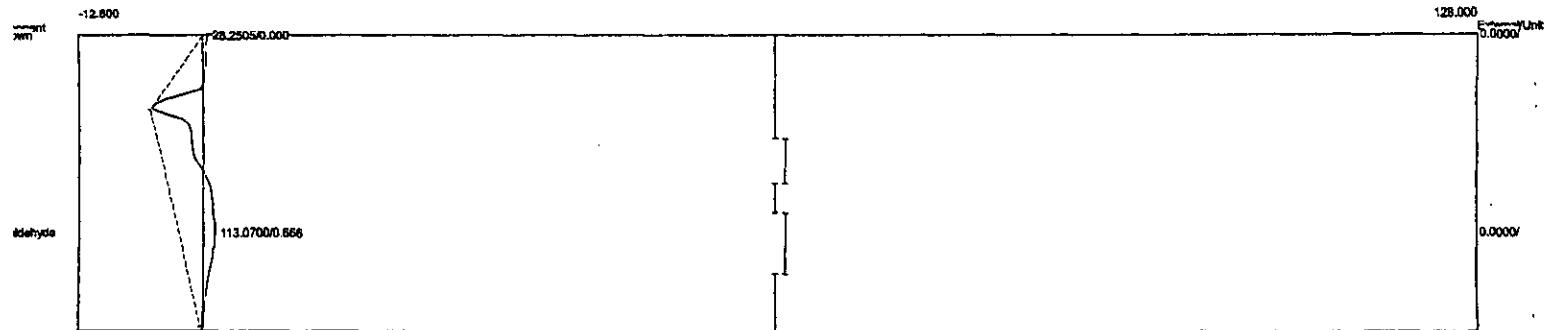
Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

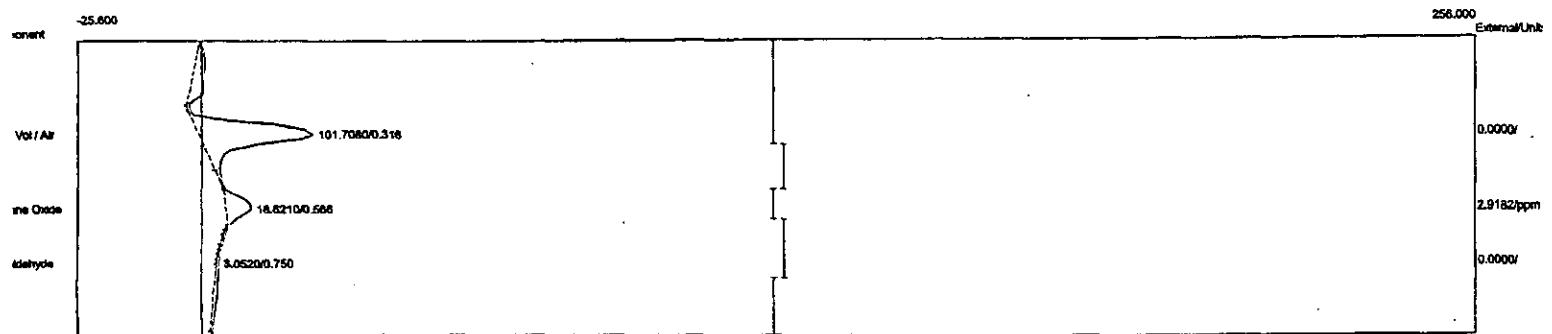
ad Vol / Air	0.333	91.3900	0.0000	
Ethylene Oxide	0.566	11.6950	1.8328	ppm
Formaldehyde	0.783	1.6100	0.0000	
	104.6950		1.8328	

Client: Sterigenics - Willowbrook 1
Client ID: Run#2Exh
Date: 12/12/2016 15:08:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, CarboPack B
Carrier: HELIUM
Temp. prog: C:\peak359\eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2016-2E06.CHR (c:\peak359)
Sample: DEOXX Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
aldehyde	0.666	113.0700	0.0000	
		113.0700	0.0000	

Client: Sterigenics - Willowbrook 1
Client ID: Run#2Exh
Analysis date: 12/12/2016 15:09:46
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: C:\peak359\eto-100.tern
Components: eto2-100.cpt
Data file: 2Ster1WB2016-2E07.CHR (c:\peak359)
Sample: DEOXX Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Vol / Air	0.316	101.7080	0.0000	
Ethylene Oxide	0.566	18.6210	2.9182	ppm
Formaldehyde	0.750	3.0520	0.0000	
	123.3810	2.9182		

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:11:10

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

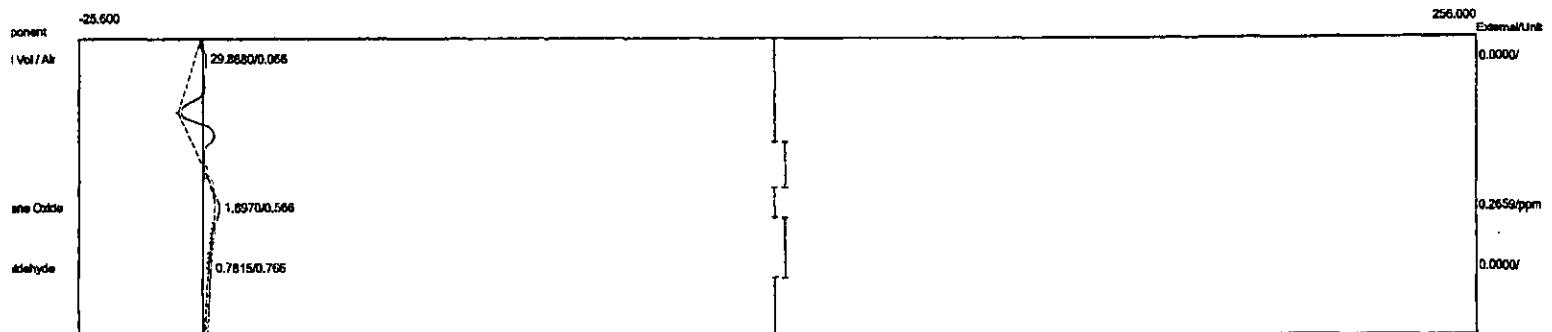
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E08.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Air	0.066	29.8680	0.0000	
Ethylene Oxide	0.566	1.6970	0.2659	ppm
Formaldehyde	0.766	0.7815	0.0000	

32.3465 0.2659

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:12:28

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

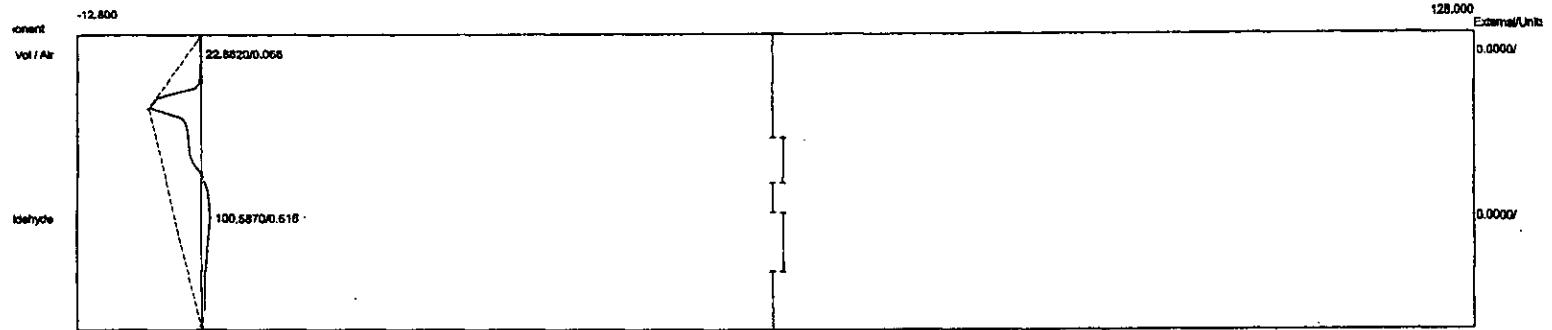
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E09.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



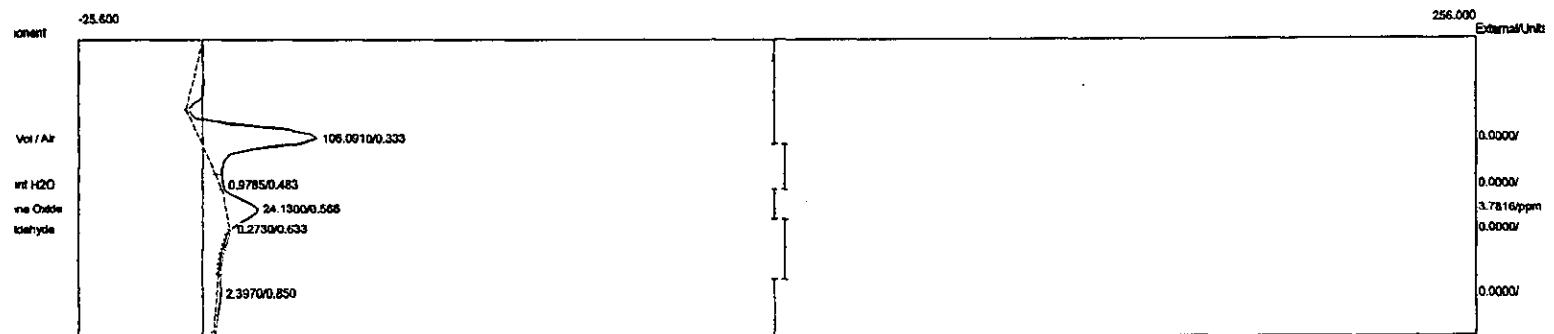
Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.066	22.8820	0.0000	
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Acetaldehyde	0.616	100.5870	0.0000	
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	123.4690	0.0000		
--	----------	--------	--	--

Client: Sterigenics - Willowbrook 1
 Client ID: Run#2Exh
 Analysis date: 12/12/2016 15:13:41
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: C:\peak359\eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster1WB2016-2E10.CHR (c:\peak359)
 Sample: DEOXX Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.333	106.0910	0.0000	
ambient H2O	0.483	0.9785	0.0000	
Ethylene Oxide	0.566	24.1300	3.7816	ppm
Formaldehyde	0.633	0.2730	0.0000	
I2	0.850	2.3970	0.0000	
		133.8695	3.7816	

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:15:13

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

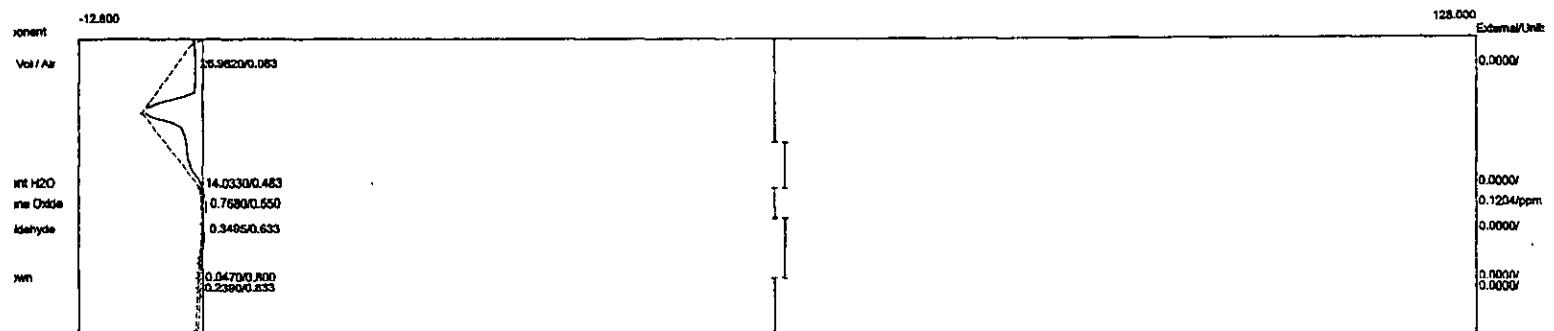
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E11.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	26.9820	0.0000
Ambient H2O	0.483	14.0330	0.0000
Ethylene Oxide	0.550	0.7680	0.1204 ppm
Formaldehyde	0.633	0.3495	0.0000
I2	0.833	0.2390	0.0000

	42.3715	0.1204
--	---------	--------

Client: Sterigenics - Willowbrook 1

Client ID: Run#2Exh

Analysis date: 12/12/2016 15:16:33

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

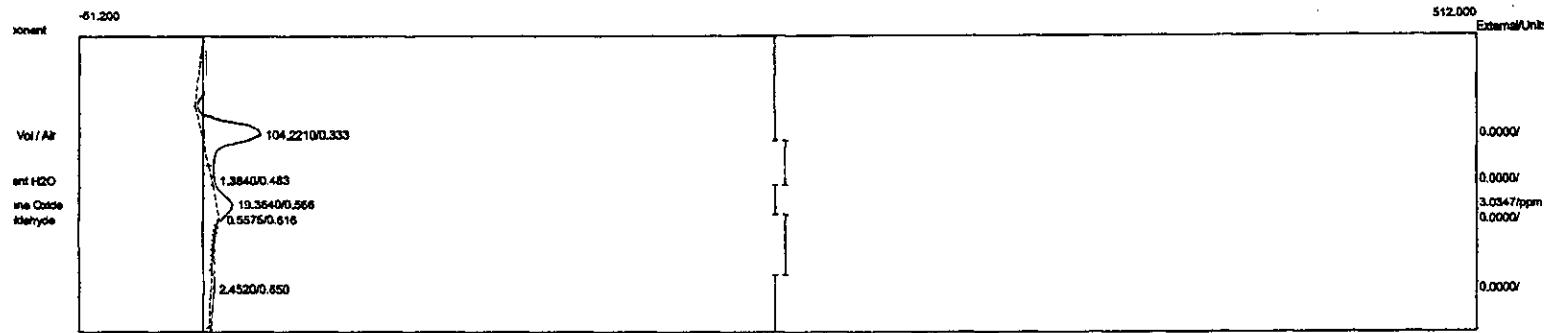
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-2E12.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.333	104.2210	0.0000	
Ambient H2O	0.483	1.3840	0.0000	
Ethylene Oxide	0.566	19.3640	3.0347 ppm	
Formaldehyde	0.616	0.5575	0.0000	
H2	0.850	2.4520	0.0000	
		127.9785	3.0347	

APPENDIX D

Run#3 Chromatograms

Client: Sterigenics - Willowbrook 1

Client ID: Run#3Exh

Analysis date: 12/12/2016 15:41:52

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

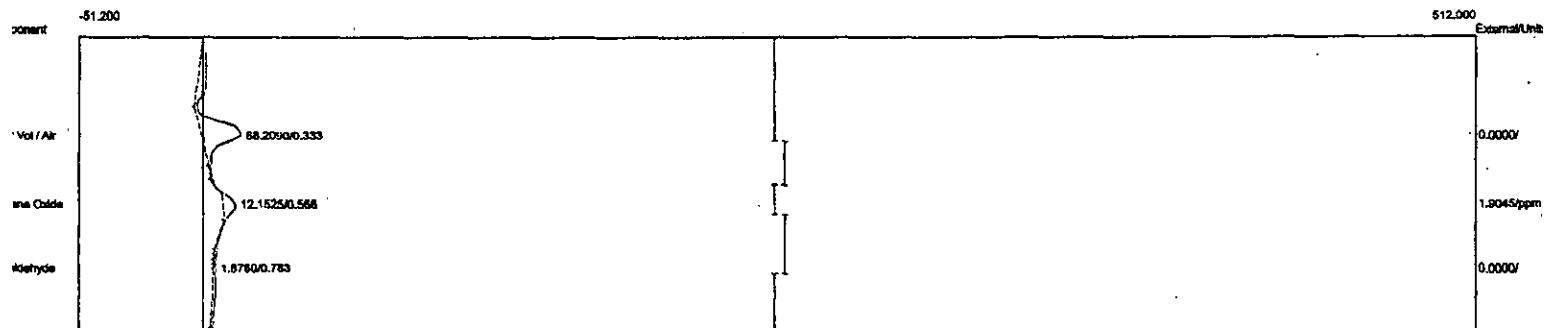
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-3E01.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.333	68.2090	0.0000	
Ethylene Oxide	0.566	12.1525	1.9045	ppm
Formaldehyde	0.783	1.8760	0.0000	
		82.2375	1.9045	

Client: Sterigenics - Willowbrook 1

Client ID: Run#3Exh

Analysis date: 12/12/2016 15:43:18

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

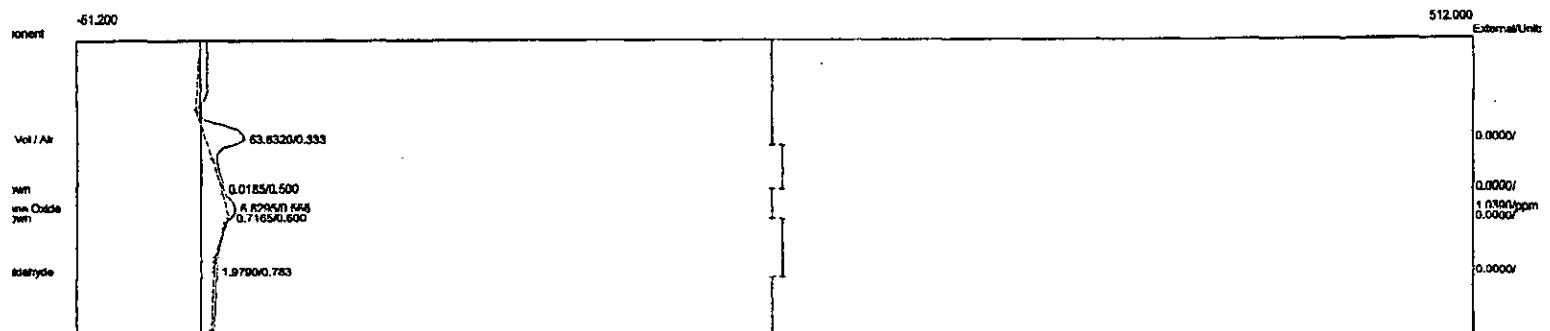
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-3E02.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.333	63.8320	0.0000	
Ethylene Oxide	0.566	6.6295	1.0390	ppm
Formaldehyde	0.783	1.9790	0.0000	

72.4405	1.0390
---------	--------

Client: Sterigenics - Willowbrook 1

Client ID: Run#3Exh

Analysis date: 12/12/2016 15:44:38

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

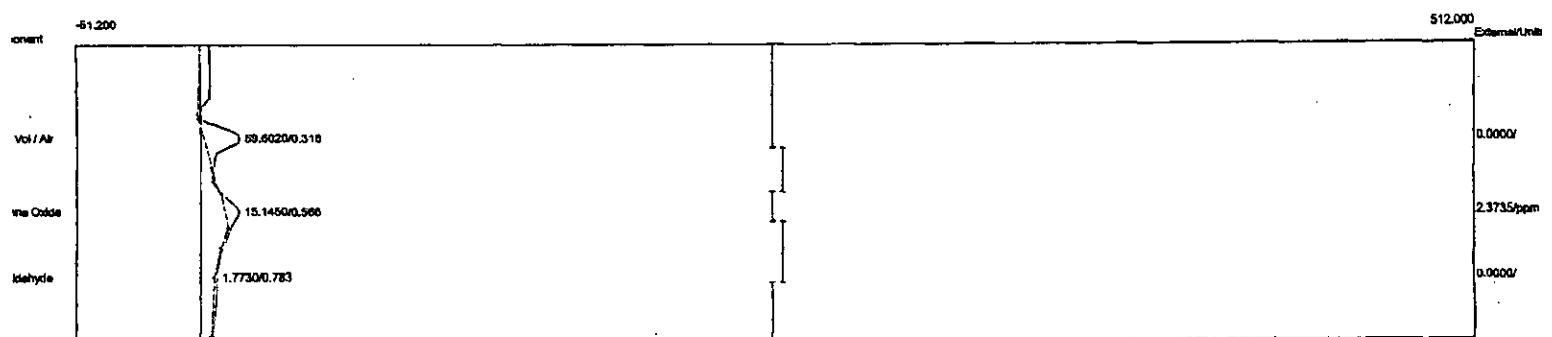
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-3E03.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Vol / Air	0.316	59.6020	0.0000	
Ethylene Oxide	0.566	15.1450	2.3735	ppm
Formaldehyde	0.783	1.7730	0.0000	

76.5200	2.3735
---------	--------

Client: Sterigenics - Willowbrook 1

Client ID: Run#3Exh

Analysis date: 12/12/2016 15:45:59

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

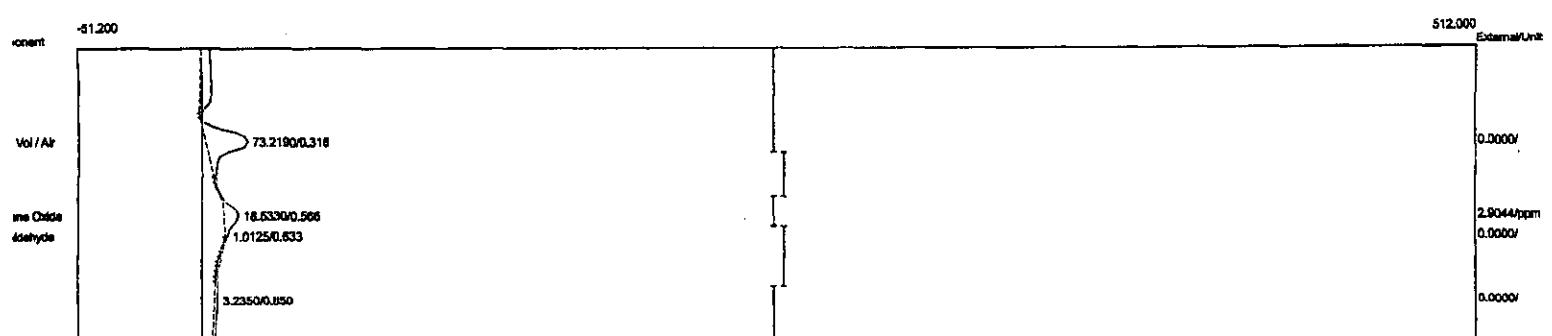
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-3E04.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.316	73.2190	0.0000	
Ethylene Oxide	0.566	18.5330	2.9044	ppm
Formaldehyde	0.633	1.0125	0.0000	
12	0.850	3.2350	0.0000	
	95.9995	2.9044		

Client: Sterigenics - Willowbrook 1

Client ID: Run#3Exh

Analysis date: 12/12/2016 15:47:19

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

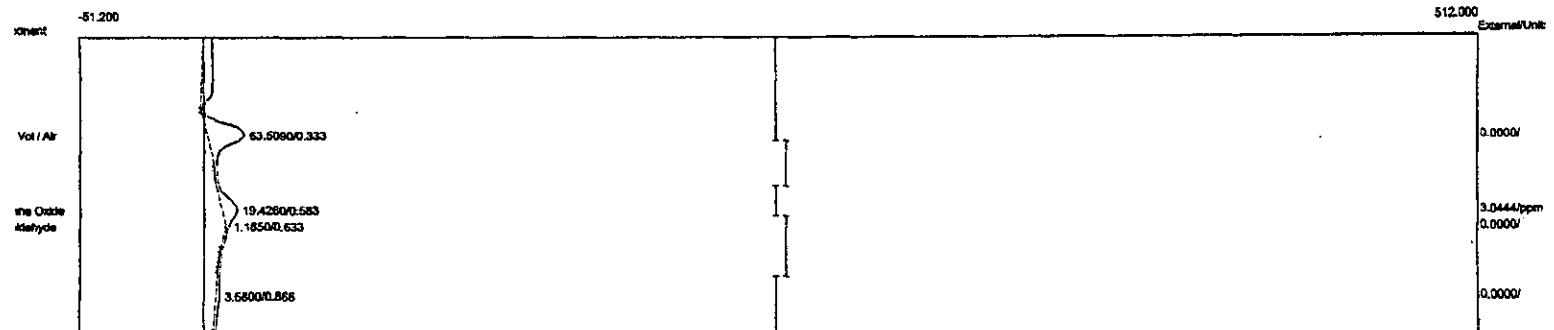
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-3E05.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.333	63.5090	0.0000	
Ethylene Oxide	0.583	19.4260	3.0444	ppm
Formaldehyde	0.633	1.1650	0.0000	
I ₂	0.866	3.6800	0.0000	
		87.7800	3.0444	

Client: Sterigenics - Willowbrook 1

Client ID: Run#3Exh

Analysis date: 12/12/2016 15:48:41

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

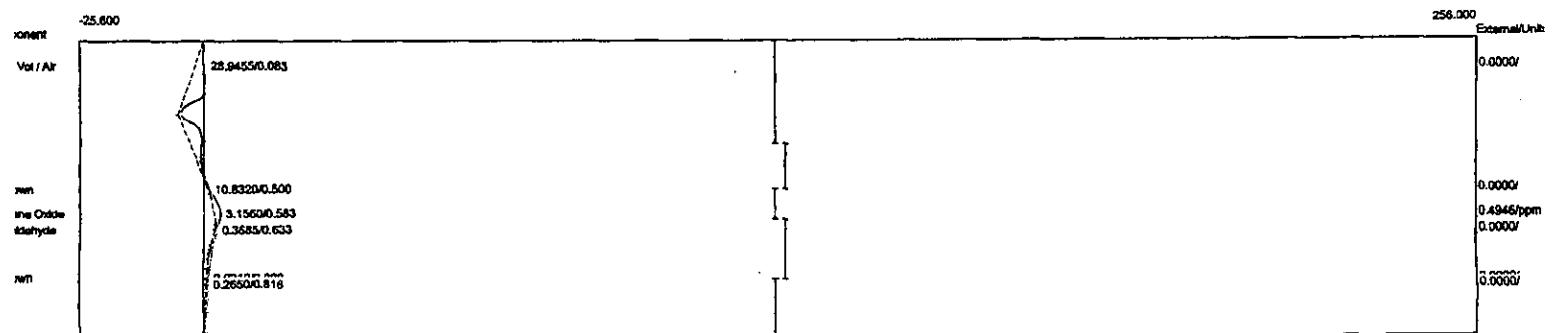
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-3E06.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	28.9455	0.0000	
Ethylene Oxide	0.583	3.1560	0.4946	ppm
Formaldehyde	0.633	0.3685	0.0000	
O2	0.816	0.2650	0.0000	
	32.7350	0.4946		

Client: Sterigenics - Willowbrook 1

Client ID: Run#3Exh

Analysis date: 12/12/2016 15:50:14

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

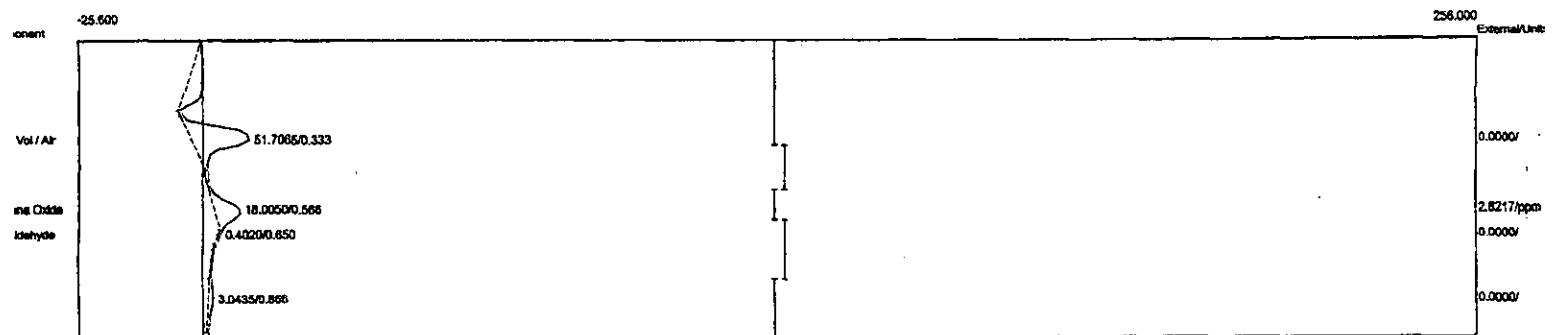
Temp. prog: C:\peak359\eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster1WB2016-3E07.CHR (c:\peak359)

Sample: DEOXX Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.333	51.7065	0.0000	
Ethylene Oxide	0.566	18.0050	2.8217	ppm
Formaldehyde	0.650	0.4020	0.0000	
I ₂	0.866	3.0435	0.0000	
		73.1570	2.8217	

APPENDIX E
Field Data and Calculation Worksheets

ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #1 - Chamber 2 (DEOXX Scrubber Outlet)

Sterigenics, Inc. - Willowbrook 1

December 12, 2016

<u>DeltaP</u>	<u>SqRtDeltaP</u>	<u>Temp (F)</u>	<u>ppm EtO</u>	<u>1-%H2O =</u>	0.97
0.01	0.1000	42.5	0.01	<u>mw =</u>	28.54
0.015	0.1225	39.7	0.01	<u>stack ID =</u>	6 in.
0.015	0.1225	37.5	0.01	<u>stack area =</u>	0.196 sq. in.
0.01	0.1000	41.2	0.01	<u>press =</u>	29.20
0.0075	0.0866	35.9	0.01	<u>Tstd =</u>	528
0.0075	0.0866	37.1	0.16	<u>Pstd =</u>	29.92
0.005	0.0707	33.3	0.21	<u>Cp =</u>	0.99
0.005	0.0707	36.4	0.01	<u>Kp =</u>	85.49
0.005	0.0707	34.7	0.68	<u>Velocity =</u>	5.4 ft/sec
0.005	0.0707	35.3	0.01	<u>Flow =</u>	63.8 dscfm
0.0025	0.0500	36.6	0.06	<u>MWeto =</u>	44.05
0.0025	0.0500	34.4	1.33	<u>MolVol =</u>	385.32
0.0025	0.0500	35.7	0.01	<u>ppmv/ft3 =</u>	1000000
0.0025	0.0500	33.1	1.71	<u>EtO Mass Flow =</u>	0.0000022 lbs/min
Average =					
0.0068	0.0824	36.7	0.3021	<u>evac start =</u>	1431
		= 497	degR	<u>evac stop =</u>	1450
				<u>min/cycle =</u>	19
				<u>EtO Emissions =</u>	0.0000419 lbs/cycle

INLET CALCULATION:

Pre-Evac:	V = 1350	ft3	Post-Evac:	V = 1350	ft3
	P = 14.6	in Hg Abs		P = 3.0	in Hg Abs
	T = 125	degF		T = 125	degF
	R = 10.73			R = 10.73	
	mw = 44.05			mw = 44.05	
Ibs EtO @ 100% =	67.80	lbs	Ibs EtO @ 100% =	13.93	lbs

$$\begin{aligned} \text{Initial EtO} &= \text{Scale Wt.} = 59.6 \text{ lbs} \\ \% \text{ EtO} @ \text{Chamber} &= \text{Scale Wt. / Ibs EtO} @ 100\% \text{ (Pre)} = 87.9 \% \\ \text{Final EtO} &= \% \text{ EtO} @ \text{Chamber} \times \text{Ibs EtO} @ 100\% \text{ (Post)} = 12.2 \text{ lbs} \\ \text{INLET ETO} &= \text{Initial EtO} - \text{Final EtO} = 47.4 \text{ lbs} \end{aligned}$$

CONTROL EFFICIENCY = 99.999912 %

ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #2 - Chamber 8 (DEOXX Scrubber Outlet)

Sterigenics, Inc. - Willowbrook 1

December 12, 2016

<u>DeltaP</u>	<u>SqRtDeltaP</u>	<u>Temp (F)</u>	<u>ppm EtO</u>	<u>1-%H2O =</u>	0.97
0.01	0.1000	36.1	1.73	<u>mw =</u>	28.54
0.015	0.1225	37.3	1.46	<u>stack ID =</u>	6 in.
0.01	0.1000	36.1	0.66	<u>stack area =</u>	0.196 sq. in.
0.01	0.1000	35.2	0.08	<u>press =</u>	29.20
0.0075	0.0866	35.9	1.83	<u>Tstd =</u>	528
0.0075	0.0866	32.9	0.01	<u>Pstd =</u>	29.92
0.005	0.0707	34.5	2.92	<u>Cp =</u>	0.99
0.005	0.0707	33.4	0.27	<u>Kp =</u>	85.49
0.005	0.0707	31.7	0.01	<u>Velocity =</u>	5.5 ft/sec
0.005	0.0707	34.5	3.78	<u>Flow =</u>	65.4 dscfm
0.0025	0.0500	31.0	0.12	<u>MWeto =</u>	44.05
0.0025	0.0500	32.2	3.03	<u>MolVol =</u>	385.32
				<u>ppmv/ft3 =</u>	1000000
Average =					
0.0071	0.0842	34.2	1.325	<u>EtO Mass Flow =</u>	0.0000099 lbs/min
	=	494	degR	<u>evac start =</u>	1500
				<u>evac stop =</u>	1517
				<u>min/cycle =</u>	17
				<u>EtO Emissions =</u>	0.0001683 lbs/cycle

INLET CALCULATION:

Pre-Evac:	V =	1456	ft3	Post-Evac:	V =	1456	ft3
	P =	14.4	in Hg Abs		P =	3.0	in Hg Abs
	T =	125	degF		T =	125	degF
	R =	10.73			R =	10.73	
	mw =	44.05			mw =	44.05	
Ibs EtO @ 100% =		72.12	Ibs	Ibs EtO @ 100% =		15.03	Ibs

$$\text{Initial EtO} = \text{Scale Wt.} = 64.2 \text{ lbs}$$

$$\% \text{ EtO} @ \text{Chamber} = \text{Scale Wt. / Ibs EtO} @ 100\% (\text{Pre}) = 89.0 \text{ %}$$

$$\text{Final EtO} = \% \text{ EtO} @ \text{Chamber} \times \text{Ibs EtO} @ 100\% (\text{Post}) = 13.4 \text{ lbs}$$

$$\text{INLET ETO} = \text{Initial EtO} - \text{Final EtO} = 50.8 \text{ lbs}$$

$$\text{CONTROL EFFICIENCY} = 99.999669 \text{ %}$$

ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #3 - Chamber 3 (DEOXX Scrubber Outlet)

Sterigenics, Inc. - Willowbrook 1

December 12, 2016

<u>DeltaP</u>	<u>SqRtDeltaP</u>	<u>Temp (F)</u>	<u>ppm EtO</u>	<u>1-%H2O =</u>	0.97
0.01	0.1000	47.7	1.90	<u>mw =</u>	28.54
0.015	0.1225	47.3	1.04	<u>stack ID =</u>	6 in.
0.01	0.1000	46.6	2.37	<u>stack area =</u>	0.196 sq. in.
0.0075	0.0866	47.3	2.90	<u>press =</u>	29.20
0.005	0.0707	48.0	3.04	<u>Tstd =</u>	528
0.005	0.0707	46.8	0.49	<u>Pstd =</u>	29.92
0.0025	0.0500	49.2	2.82	<u>Cp =</u>	0.99
Average =				<u>Kp =</u>	85.49
0.0079	0.0886	47.6	2.080	<u>Velocity =</u>	5.9 ft/sec
		= 508	degR	<u>Flow =</u>	67.9 dscfm
				<u>MWeto =</u>	44.05
				<u>MolVol =</u>	385.32
				<u>ppmv/ft3 =</u>	1000000
				<u>EtO Mass Flow =</u>	0.0000162 lbs/min
				<u>evac start =</u>	1540
				<u>evac stop =</u>	1551
				<u>min/cycle =</u>	11
				<u>EtO Emissions =</u>	0.0001777 lbs/cycle

INLET CALCULATION:

Pre-Evac:	V =	663	ft3	Post-Evac:	V =	663	ft3
	P =	14.1	in Hg Abs		P =	3.0	in Hg Abs
	T =	125	degF		T =	125	degF
	R =	10.73			R =	10.73	
	mw =	44.05			mw =	44.05	
Ibs EtO @ 100% =		32.16	Ibs	Ibs EtO @ 100% =		6.84	Ibs

Initial EtO = Scale Wt. =	30.1	Ibs
% EtO @ Chamber = Scale Wt. / Ibs EtO @ 100% (Pre) =	93.6	%
Final EtO = % EtO @ Chamber X Ibs EtO @ 100% (Post) =	6.4	Ibs
INLET ETO = Initial EtO - Final EtO =	23.7	Ibs

CONTROL EFFICIENCY = **99.999250 %**

APPENDIX F
Gas Certifications



Scott Specialty Gases

500 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-001
Item No.: 02020001310TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CAL4448
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

<u>Component Name</u>	<u>Concentration (Moles)</u>	<u>Accuracy (+/-%)</u>
ETHYLENE OXIDE NITROGEN	1.10 PPM BALANCE	5

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:

MT

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	1.	PPM BAL	1.10 PPM BAL	10.0
NITROGEN				5.00

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL Pressure: 1300 PSIG
 Expiration Date: 18Apr2018

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



Scott Specialty Gases

300 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-003
Item No.: 02020001320TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CLM003232
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

<u>Component Name</u>	<u>Concentration (Moles)</u>	<u>Accuracy (+/-%)</u>
ETHYLENE OXIDE	10.1	5
NITROGEN	PPM BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:

MT

MT

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10.	PPM BAL	10.1 PPM BAL	1.0
NITROGEN				5.00

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL Pressure: 1400 PSIG
Expiration Date: 18Apr2018

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



Scott Specialty Gases

100 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-004
Item No.: 02020001330TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CLM011385
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

<u>Component Name</u>	<u>Concentration (Moles)</u>	<u>Accuracy (+/-%)</u>
ETHYLENE OXIDE NITROGEN	100. PPM BALANCE	5

TRACEABILITY

Traceable To:

Scott Reference Standard

APPROVED BY:

B. Mc Cully
BLM

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE NITROGEN	100. BAL	100. BAL	.0	5.00

TRACEABILITY

Traceable To
Scott Reference Standard.

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1400 PSIG
Expiration Date: 18Apr2018

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



Scott Specialty Gases

300 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-005
Item No.: 02020001340TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CLM002810
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)	Accuracy (+/-%)
ETHYLENE OXIDE NITROGEN	1,000. PPM BALANCE	5

TRACEABILITY

Traceable To:

Scott Reference Standard

APPROVED BY:

BLM

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	1,000.	PPM BAL	1,000.	PPM BAL	.0	5.00
NITROGEN						

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1300 PSIG
Expiration Date: 18Apr2018

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



Scott Specialty Gases

300 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-006
Item No.: 02020001340TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CLM005787
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)	Accuracy (+/-%)
ETHYLENE OXIDE NITROGEN	10,080. PPM BALANCE	5

TRACEABILITY

Traceable To:

Scott Reference Standard

APPROVED BY:

B. M. Kelly
BLM

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10,000.	PPM BAL	10,080. PPM BAL	.8
NITROGEN				5.00

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 800 PSIG
Expiration Date: 18Apr2018

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

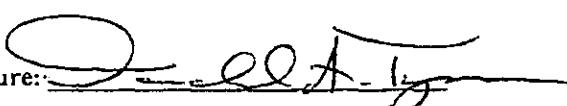
Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

MESA**CERTIFICATE OF ANALYSIS**

Customer Name:	ECSi, Inc.	Cylinder Number:	SA25925
Stock or Analyzer Tag Number:	N/A	Product Class:	Certified Standard
Customer Reference:	Verbal- Dan	Cylinder - Contents ¹ :	28 CF @ 2000 PSI
MESA Reference:	104448	Cylinder-CGA:	A006-HP-BR/350
Date of Certification:	4/20/2016	Analysis Method:	GC-TCD/FID
Recommended Shelf Life:	2 Years	Preparation Method:	Gravimetric

Component	Requested Concentration ²	Reported Concentration ^{2,3}
Ethylene Oxide	50 ppm	48.8 ppm
Nitrogen	Balance	Balance

Authorized Signature: 

1. The fill pressure shown on the COA is as originally quoted. The fill pressure measured by the customer may differ from the fill pressure originally quoted due to temperature effects, compressibility of the individual components when blended together in the cylinder, gauge accuracy or reduction in content volume before shipping as a result of samples withdrawn for laboratory QC necessary to ensure product quality.
2. Unless otherwise stated, concentrations are given in molar units.
3. Vapor pressure mixes are blended at a sufficiently low pressure so as to eliminate phase separation under most low temperature conditions encountered during transport or storage. However, it is generally recommended that cylinders containing vapor pressure restricted mixes be placed on the floor in a horizontal position and rolled back and forth to improve homogeneity of the gas phase mixture before being put into service.

Analytical Gas Standards are prepared and analyzed using combinations of NIST traceable weights, SRM's provided by NIST, or internal gas standards that have been verified for accuracy using procedures published by the US-EPA. Pure gases are analyzed and certified for purity using minor component Analytical Gas Standards prepared according to the methods specified above. Balances are calibrated to NIST test weights covered by NIST test number 822/256175/96. Reference Certification #'s: 163/W, 830/N and 3280. Calibration methods are in conformance with MIL-STD 45662A.

MESA Specialty Gases & Equipment

division of MESA International Technologies, Inc.

3619 Pendleton Avenue, Suite C • Santa Ana, California 92704 • USA
TEL.: 714-434-7102 • FAX: 714-434-8006 • E-mail: mail@mesagas.comOn-line Catalog at www.mesagas.com

APPENDIX G
Process/Parametric Monitoring Data

I ANTARES KORSCH V30-4
RUN NUMBER 1860427

12/12/16 Mon 18:34

CYCLE 751 CHECK VALUE 22130

TIME	PRESS INHG	TEMP (DEG F) AVG	RH %	VAP GAS	ETO MG/L	H2O MG/L	ALARMS & MESSAGES	ACTION TAKEN
8:34	14.4	126		120	672	16.6		
MAX:	14.4	126		120	672	16.6	PHASE 0:12	PHASE ELAPSED 0:12
MIN:	2.0	125		76	0	2.2		CYCLE 2:20

STERILANT USED THIS PHASE: 59.6, CYCLE TOTAL: 59.6

GAS DWELL (EO) PHASE

8:35	14.4	126		120	686	16.9		
8:35	14.4	126		120	690	17.1		OPERATOR CYCLE STOP
8:35	OPERATOR SENSOR CHECK --	PR	48.8,	RH	117,	JWT	130,	VLT 82, VGX 120
	CT1 127, CT2 124, CT3 126,	P01	124,	P02	82,	P03	82,	P04 82
	P05 82, P06 82, P07 82,	P08	82,	P09	82,	P10	82,	P11 82
	P12 82, P13 82, P14 82,	P15	82,	P16	82,	P17	82,	P18 82
	P19 82, P20 82,	ETO	704,	H2O	17.2,	WT	295.1	
8:35	"RC 12DEC2016							
8:36	14.4	126		119	706	17.2		
8:37	14.4	126		118	709	17.2		
8:38	14.4	126		117	711	17.2		
8:39	14.4	126		116	711	17.7		
8:40	14.4	126		116	711	17.5		
8:41	14.4	126		115	712	17.7		
8:42	14.4	126		115	712	17.7		
8:43	14.4	126		114	711	17.7		
8:44	14.4	126		114	711	17.7		
8:45	14.4	125		114	711	18.0		
8:46	14.4	125		113	711	18.1		
8:47	14.4	125		113	711	18.1		
8:48	14.4	125		113	711	18.1		
8:49	14.4	125		112	711	18.3		
8:50	14.4	125		112	711	18.6		
8:50	14.4	125		112	711	18.6	CYCLE STILL STOPPED	
8:51	14.4	125		112	711	18.6		
8:52	14.4	125		112	711	19.1		
8:53	14.4	125		112	711	19.1		
8:54	14.4	125		111	711	19.1		
8:55	14.4	125		111	711	19.1		
8:56	14.4	125		111	711	19.1		
8:57	14.4	125		111	711	19.5		
8:58	14.4	125		111	711	19.7		
8:59	14.4	125		111	711	19.5		
9:00	14.4	125		110	711	19.9		
9:01	14.4	125		110	711	19.9		
9:02	14.4	125		110	711	19.9		
9:03	14.4	125		110	711	19.9		
9:04	14.4	125		110	711	19.9		
9:05	14.4	125		110	711	19.9		
9:05	14.4	125		110	712	19.9	CYCLE STILL STOPPED	
9:06	14.4	125		110	712	20.1		
9:07	14.4	125		110	713	20.4		

I ANTARES KORSCH V30-4
RUN NUMBER 1860427

12/12/16 Mon 20:27

CYCLE 751 CHECK VALUE 22130

TIME	PRESS INHGA	TEMP AVG	(DEG F)	RH %	VAP GAS	ETO MG/L	H2O MG/L	ALARMS & MESSAGES	ACTION TAKEN
0:27	14.6	125			107	713	25.9		
0:28	14.6	125			107	713	25.9		
0:29	14.6	125			107	713	25.9		
0:30	14.6	125			107	713	25.9		
0:31	14.6	125			107	713	25.9		
0:32	14.6	125			107	713	25.9		
0:33	14.6	125			107	713	25.9		
0:33	14.6	125			107	713	26.0		OPERATOR CYCLE ABORT
0:33	14.6	125			107	713	26.0	SHORT EXPOSURE	
0:33	14.6	125			107	713	26.0		
MAX:	14.6	126			120	716	26.0	PHASE 0:00	PHASE ELAPSED 1:58
MIN:	14.4	125			107	686	16.9		CYCLE 4:18

AFTER VACUUM PHASE

0:33	14.6	125			107	713	26.2		
0:34	13.6	125			94	699	25.9		
0:35	12.5	125			94	638	24.4		
0:35	12.4	125			94	638	24.4	SLOW EVACUATION	
0:35	OPERATOR SENSOR CHECK --	PR CT1 126, CT2 123, P05 81, P06 81, P07 81, P12 81, P13 81, P14 81, P19 81, P20 81,	41.6, P01 125, P08 81, P09 81, P15 81, P16 81, ET0 627,	RH 121, P02 81, P03 81, P10 81, P11 81, P17 81, P18 81,	130, P04 81, P12 81, P13 81, P14 81, P15 81, P16 81, P17 81, P18 81,	VLT 81, P05 81, P06 81, P07 81, P12 81, P13 81, P14 81, P15 81, P16 81, P17 81, P18 81,	VGX 95, P08 81, P09 81, P10 81, P11 81, P12 81, P13 81, P14 81, P15 81, P16 81, P17 81, P18 81,	95, P04 81, P11 81, P12 81, P13 81, P14 81, P15 81, P16 81, P17 81, P18 81,	
0:36	11.5	125			95	589	23.5		
0:37	10.5	125			96	541	22.3		
0:38	9.7	125			96	498	20.7		
0:39	9.0	125			97	458	19.8		
0:40	8.3	125			97	422	18.8		
0:41	7.6	125			98	389	17.7		
0:42	7.1	125			98	358	16.8		
0:43	6.5	125			99	331	15.9		
0:44	6.0	125			100	307	15.0		
0:45	5.6	125			100	283	14.3		
0:46	5.1	125			100	262	13.1		
0:47	4.8	125			101	244	12.7		
0:48	4.4	125			101	226	11.8		
0:49	4.1	125			102	210	11.6		
0:50	3.8	125			102	195	10.9		
0:51	3.5	125			102	179	10.4		
0:52	3.2	125			103	166	9.6		
0:53	3.0	125			103	156	9.3	EVACUATION PRESSURE	
0:53	3.0	125			103	156	9.3		
MAX:	14.6	125			107	713	26.2	PHASE 0:19	PHASE ELAPSED 0:19
MIN:	3.0	125			94	156	9.3		CYCLE 4:38

STERIGENICS
7775 S QUINCY STREET
WILLOWSBROOK, IL 60527
1-630-654-5151
CHAMBER NO. 8

SC 12 DEC 16

DATE 12/12/16 Mon CYCLE 751 STERILANT EO
PROG VERSION KORSCP V3Q-4 CHECK VALUE 22130
IN NUMBER 1852745 OPERATOR R CASTELLANO

ISTOMER MAINTENANCE
IT NO. ENG #2 30NOV2016
IANTITY NA
ODUCT NA

IRRENT TANK: LOT # E002374UTLX902993L16, TARE 283.0 LB
TALE WEIGHT 433.4 LB, STERILANT LEFT 145.4 LB

PROCESS PARAMETERS

CHAMBER TEMP 125 F, COOL AT 135 F, BLOWER IS USED, ALARM REPETITION 15:00 MM:SS
 VACUUM A 2.0 INHG, 2.01 INHG/MIN, REQD 3.0 INHG
 LEAK TEST 0:05 HH:MM, TOLERANCE 0.2 INHG
 NITROGEN DILUTION 2 CYCLES; NITROGEN: 24.0 INHG, 1.51 INHG/MIN
 EVAC: 2.0 INHG, 2.01 INHG/MIN
 GAS A 1 CYCLES; INJ: 14.4 INHG, 1.00 INHG/MIN, EO
 GAS DWELL 14.4 INHG, -0.2 INHG, DWELL 1:00 HH:MM
 AFTER VACUUM 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN, REQD 3.5 INHG
 GAS WASH A 3 CYCLES RLS: 23.0 INHG, 1.51 INHG/MIN, NITR
 VAC: 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN
 REQD 3.5 INHG
 GAS WASH B 1 CYCLES RLS: 23.0 INHG, 1.51 INHG/MIN, AIR
 VAC: 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN
 REQD 3.5 INHG
 RELEASE 28.0 INHG, 1.51 INHG/MIN

TIME	PRESS	TEMP (DEG F)	RH	VAP	ETO	H2O	ALARMS & MESSAGES				ACTION TAKEN	
	INHG	AVG	%	GAS	MG/L	MG/L						
7:13	OPERATOR SENSOR CHECK --	PR 100.1,	RH 0,	JWT 128,	VLT 85,	VGX 108						
	CT1 125, CT2 127, CT3 124, P01 85, P06 85, P07 85, P08 85, P12 85, P13 85, P14 85, P15 85, P19 85, P20 85, ETO 0,	P01 127, P02 85, P03 85, P09 85, P10 85, P16 85, P17 85, P18 85, H2O 7.0, WT 433.3										
	VACUUM A PHASE											
7:15	29.4	125	107	0	5.7							
7:15	OPERATOR SENSOR CHECK --	PR 99.4,	RH 0,	JWT 127,	VLT 85,	VGX 107						
	CT1 124, CT2 127, CT3 123, P01 85, P06 85, P07 85, P08 85, P12 85, P13 85, P14 85, P15 85, P19 85, P20 85, ETO 0,	P01 127, P02 85, P03 85, P09 85, P10 85, P16 85, P17 85, P18 85, H2O 5.6, WT 433.4										
7:16	27.3	125	107	0	5.4							
7:17	25.3	125	107	0	5.1							
7:18	23.2	124	107	0	4.7							
7:19	21.2	124	107	0	4.2							

DI ANTARES KORSCH V3Q-4

12/12/16 Mon 19:02

CYCLE 751

CHECK VALUE 22130

JN NUMBER 1852745

TIME	PRESS	TEMP	(DEG F)	RH	VAP	ETO	H2O	ALARMS & MESSAGES				ACTION TAKEN		
	INHG	Avg	%		GAS	MG/L	MG/L							
19:02	3.2	129			89	3	0.1							
19:03	4.2	129			75	69	0.1							
19:04	5.2	129			80	140	2.1							
19:05	6.2	129			90	206	3.3							
19:06	7.2	129			99	260	4.2							
19:07	OPERATOR SENSOR CHECK --			PR	27.1,	RH		0,	JWT	139,	VLT	85,	VGX	96
	CT1	129,	CT2	130,	CT3	129,	P01	130,	P02	85,	P03	85,	P04	85
	P05	85,	P06	85,	P07	85,	P08	85,	P09	85,	P10	85,	P11	85
	P12	85,	P13	85,	P14	85,	P15	85,	P16	85,	P17	85,	P18	85
	P19	85,	P20	85,	ETO	294,	H2O	4.8,	WT	401.9				
19:07	8.2	129			104	320	5.3							
19:08	9.2	129			110	381	6.4							
19:09	10.2	129			113	440	7.6							
19:10	11.2	129			116	495	8.3							
19:11	12.2	129			117	557	9.2							
19:12	13.2	129			118	618	10.1							
19:13	14.2	129			118	673	10.6							
19:13	14.4	129			118	698	10.7							
MAX:	14.4	129			118	698	10.7		PHASE	0:12	PHASE	ELAPSED	0:12	
MIN:	2.0	128			75	0	0.1					CYCLE	1:58	

STERILANT USED THIS PHASE: 64.2, CYCLE TOTAL: 64.2

GAS DWELL (EO) PHASE

9:13	14.5	129		118	706	10.9								
9:14	14.5	129		117	727	11.1								
9:15	14.5	129		117	729	11.1								
9:15	OPERATOR SENSOR CHECK --			PR	49.0,	RH		0,	JWT	137,	VLT	85,	VGX	117
	CT1	128,	CT2	130,	CT3	129,	P01	130,	P02	85,	P03	85,	P04	85
	P05	85,	P06	85,	P07	85,	P08	85,	P09	85,	P10	85,	P11	85
	P12	85,	P13	85,	P14	85,	P15	85,	P16	85,	P17	85,	P18	85
9:15	"RC 12DEC2016			P19	85,	P20	85,	ETO	729,	H2O	11.1,	WT	369.0	
9:15	14.5	129		117	729	11.5								
9:16	14.5	129		116	732	11.5								
9:17	14.4	129		116	734	11.5								
9:18	14.4	129		115	734	11.5								
9:19	14.4	129		115	734	11.5								
9:20	14.4	129		114	734	11.5								
9:21	14.4	129		114	734	11.3								
9:22	14.4	129		113	734	11.5								
9:23	14.4	129		113	734	11.5								
9:24	14.4	129		113	734	11.5								
9:25	14.4	129		112	734	11.5								
9:26	14.4	128		112	734	11.5								
9:27	14.4	128		112	734	11.5								
9:28	14.4	128		111	734	11.5								
9:29	14.4	128		111	734	11.5								
9:30	14.4	128		111	734	11.5		CYCLE STILL STOPPED						

I ANTARES KORSCP V30-4
IN NUMBER 1852745

12/12/16 Mon 20:49

CYCLE 751 CHECK VALUE 22130

TIME	PRESS INHGA	TEMP (DEG F) AVG	RH %	VAP GAS	ETO MG/L	H2O MG/L	ALARMS & MESSAGES	ACTION TAKEN
20:49	14.4	125		104	729	12.0		
20:50	14.4	125		104	729	12.0		
20:51	14.4	125		104	731	12.4		
20:52	14.4	125		104	729	12.4		
20:53	14.4	125		104	731	12.0		
20:54	14.4	125		104	732	12.0		
20:55	14.4	125		104	732	12.1		
20:56	14.4	125		104	732	12.3		
20:57	14.4	125		104	732	12.4		
20:58	14.4	125		104	732	12.4		
20:59	14.4	125		104	732	12.0		
21:00	14.4	125		104	732	12.0	CYCLE STILL STOPPED	
21:00	14.4	125		104	732	12.3		
21:01	14.4	125		104	732	12.3		OPERATOR CYCLE ABORT
21:01	14.4	125		104	732	12.3	SHORT EXPOSURE	
21:01	14.4	125		104	732	12.3		
MAX:	14.5	129		118	734	12.4	PHASE 0:01	PHASE ELAPSED 1:47
MIN:	14.4	125		104	706	10.9		CYCLE 3:46

AFTER VACUUM PHASE

1:01	14.4	125		104	732	12.3		
1:02	13.2	125		98	713	12.0		
1:03	12.0	125		98	643	10.8		
1:03	11.8	125		98	637	10.6	SLOW EVACUATION	
1:04	10.8	125		98	584	10.3		
1:05	9.8	125		98	528	9.7		
1:06	8.9	125		98	484	9.2		
1:07	8.1	125		98	439	8.3		
1:08	7.4	125		98	399	7.9		
1:09	6.7	125		98	362	6.8		
1:10	6.1	125		98	328	6.0		
1:11	5.5	125		98	300	5.6		
1:12	5.0	125		98	273	5.4		
1:13	4.5	125		99	250	4.2		
1:14	4.1	125		99	229	4.2		
1:15	3.8	125		99	210	3.8		
1:16	3.5	125		99	193	3.5		
1:17	3.2	125		100	176	3.2		
1:18	3.0	125		100	167	3.2	EVACUATION PRESSURE	
1:18	3.0	125		100	167	3.2		
MAX:	14.4	125		104	732	12.3	PHASE 0:16	PHASE ELAPSED 0:16
MIN:	3.0	125		98	167	3.2		CYCLE 4:02

GAS WASH A PHASE

1:18	3.0	125		100	167	3.2	===== RELEASE 1 =====	=====
1:19	4.6	125		90	195	3.3		

STERIGENICS
7775 QUINCY STREET
WILLOWBROOK, IL 60527
1-630-654-5151
CHAMBER NO. 3

to 12 Dec 14

DATE 12/12/16 Mon
PROG VERSION KORSOP V3Q-4
RUN NUMBER 1860454

CYCLE 751

STERILANT EO
CHECK VALUE 22130
OPERATOR R CASTELLANO

CUSTOMER MAINTENANCE
LOT NO. ENG #7-12DEC2017
QUANTITY NA
PRODUCT NA

RRENT TANK: LOT # E002916UTLX902993L16, TARE 278.0 LB
ALE WEIGHT 525.2 LB, STERILANT LEFT 242.8 LB

PROCESS PARAMETERS

CHAMBER TEMP	125 F, COOL AT 135 F, BLOWER IS USED, ALARM REPETITION 15:00 MM:SS
VACUUM A	2.0 INHG, 2.01 INHG/MIN, REQD 3.0 INHG
LEAK TEST	0:05 HH:MM, TOLERANCE 0.2 INHG
NITROGEN DILUTION	2 CYCLES; NITROGEN: 24.0 INHG, 1.51 INHG/MIN EVAC: 2.0 INHG, 2.01 INHG/MIN
GAS A	1 CYCLES; INJ: 14.4 INHG, 1.00 INHG/MIN, EO
GAS DWELL	14.4 INHG, -0.2 INHG, DWELL 1:00 HH:MM
AFTER VACUUM	3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN, REQD 3.5 INHG
GAS WASH A	3 CYCLES RLS: 23.0 INHG, 1.51 INHG/MIN, NITR VAC: 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN REQD 3.5 INHG
GAS WASH B	1 CYCLES RLS: 23.0 INHG, 1.51 INHG/MIN, AIR VAC: 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN REQD 3.5 INHG
RELEASE	26.0 INHG, 1.51 INHG/MIN

I ANTARES KORSOP V3Q-4

12/12/16 Mon 20:39

CYCLE 751

CHECK VALUE 22130

RUN NUMBER 1860454

STERILANT USED THIS PHASE: 30.1, CYCLE TOTAL: 30.1

GAS PHASE (EQ) PHASE

0:50	14.6	125	98
0:50	14.5	125	99
0:51	14.5	125	99
0:52	14.4	125	100
0:53	14.4	125	101

OPERATOR CYCLE STOP

I ANTARES KORSOP V3Q-4

12/12/16 Mon 21:42

CYCLE 751

CHECK VALUE 22130

RUN NUMBER 1868454

TIME	PRESS	TEMP	(DEG F)	RH	VAP	ALARMS & MESSAGES	ACTION TAKEN		
	INHG	Avg	%	GAS			PHASE	0:00	PHASE ELAPSED
1:42	14.1	125		112					0:31
MAX:	14.5	126		112					
MIN:	14.1	125		98					2:37

AFTER VACUUM PHASE

1:42	14.1	125	112						
1:43	12.3	125	103						
1:44	10.4	125	103						
1:44	10.3	125	103			SLOW EVACUATION			
1:45	8.9	125	104						
1:46	7.6	125	105						
1:47	6.5	125	105						
1:48	5.6	125	106						
1:49	4.8	125	106						
1:50	4.3	125	107						
1:51	3.6	125	107						
1:52	3.3	125	107						
1:53	3.0	125	107			EVACUATION PRESSURE			
1:53	3.0	125	107						
MAX:	14.1	125	112				PHASE	0:10	PHASE ELAPSED
MIN:	2.0	125	103						CYCLE 2:47

GAS WASH A PHASE

1:53	3.0	125	107			===== RELEASE 1 =====				
1:54	4.6	125	89							
1:55	6.1	125	85							
1:56	7.6	125	83							
1:57	9.1	125	82							
1:58	10.6	125	83							
1:59	12.1	125	84							
2:00	13.6	125	85							
2:01	15.1	125	85							
2:02	16.6	125	86							
2:03	18.1	125	87							
2:04	19.6	125	87							
2:05	21.1	125	88							
2:06	22.6	125	88							
2:06	23.0	125	89			===== EVACUATION 1 =====				
2:07	20.9	125	90							
2:08	19.0	125	93							
2:08	OPERATOR SENSOR CHECK --	PR	50.3,	RH	0,	JWT	129,	VLT	79,	VGX
	CT1	124,	CT2	128,	CT3	123,	P01	128,	P02	79,
	P05	79,	P06	79,	P07	79,	P08	79,	P09	79,
	P12	79,	P13	79,	P14	79,	P15	79,	P16	79,
	P19	79,	P20	79,	ETO	0,	H20	0.1,	WT	494.7
2:09	16.9	125	95							

**REPORT OF
AIR POLLUTION SOURCE TESTING
OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM
OPERATED BY STERIGENICS, INC.
IN WILLOWBROOK, ILLINOIS
ON DECEMBER 13, 2016**

Submitted to:

**ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 North Grand Avenue East
Springfield, Illinois 62794**

Submitted by:

**STERIGENICS US, LLC.
2015 Spring Road
Oak Brook, Illinois 60523**

I.D. Number 043110AAC

Prepared by:

**ECSI, INC.
PO Box 848
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January 20, 2017

ECSI

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TEST DATE

Tuesday, December 13, 2016

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ECSI

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1.0 INTRODUCTION

On Tuesday, December 13, 2016, ECSi, Inc. performed air pollution source testing of an ethylene oxide (EtO) emission-control device operated by Sterigenics, Inc. in Willowbrook, Illinois. The control device tested was a two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system, comprised of a packed-tower chemical scrubber (SC1) and a dry-bed reactor (SC2), used to control emissions from two aeration rooms and from four sterilizer vacuum pumps. The purpose of the testing program was to demonstrate continued compliance with the conditions established in the Air Quality Permit granted to Sterigenics by the Illinois Environmental Protection Agency (IEPA).

2.0 EQUIPMENT

The EtO gas-sterilization system is comprised of four commercial sterilizers, which are discharged through liquid-ring vacuum pumps to a two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system. The gas-sterilization and emission-control equipment consist of the following:

- Four Gas Sterilizers, each comprised of a steam-heated sterilization chamber, a recirculating vacuum pump chamber evacuation system, a backvent valve, and a fugitive emissions exhaust hood;
- Two aeration rooms, each comprised of a heated aeration chamber and a chamber exhaust system.

Exhaust and aeration emissions are be controlled by:

- One two-stage Advanced Air Technologies Safe Cell emission-control system, comprised of a packed-tower chemical scrubber (SC1), equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank, and a dry bed reactor/scrubber (SC2), comprised of a bank of solid-bed reaction vessels, connected in parallel, installed downstream of SC1 and upstream of a dedicated blower exhaust system.

3.0 TESTING

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT System during the first chamber evacuation of the sterilizer exhaust phase of one of the three sterilizers, and during a one-hour time interval of the aeration process. A total of three exhaust-phase test runs, and three aeration test runs were performed.

Exhaust phase testing with one sterilizer discharging to the scrubber at a time represents worst-case conditions for demonstration of control efficiency compliance. At this lower inlet loading, the scrubber must perform at its maximum efficiency to achieve outlet EtO concentrations low enough to demonstrate compliance.

During the first chamber evacuation of the exhaust phase, EtO emissions to the inlet of the AAT System were determined using the Ideal Gas Law and the chamber conditions at the beginning and at the end of the first chamber evacuation. During the first chamber evacuation of the exhaust phase, EtO emissions from the outlet of the AAT System were determined using direct source sample injection into the GC. During aeration testing, EtO emissions at the inlet and the outlet of the Safe Cell System were determined using direct source sample injection into a GC.

All exhaust phase testing was conducted during normal process load conditions, but with an empty sterilization chamber to facilitate the performance of multiple test runs. All aeration testing was performed during normal process load conditions, after freshly sterilized product had been transferred into an aeration chamber/room. The testing program was conducted in accordance with the procedures outlined in the following sections.

4.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at the Willowbrook II facility was tested to demonstrate compliance with EPA requirements, as specified in the IEPA Air Quality Permit. The following requirements must be met:

- The sterilizer exhaust phase (post exposure vacuum pulses) emissions must be vented to control equipment with an EtO emission-reduction efficiency of at least 99 % by weight.
- The emissions from the aeration process must be discharged to control equipment with an EtO emission-reduction efficiency of at least 99.0% by weight or by a maximum concentration of 1 ppmv, whichever is less stringent..

Testing is required to demonstrate compliance with these requirements. Source testing of the AAT Safe Cell System is required initially, and may be required periodically thereafter.

5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

EtO source testing was performed in accordance with the procedures outlined in USEPA CFR40, Part 63.365. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT System during the first chamber evacuation of the sterilizer exhaust phase of one of the three sterilizers. A total of three exhaust-phase test runs were performed.

Exhaust phase testing with one sterilizer discharging to the scrubber at a time represents worst-case conditions for demonstration of control efficiency compliance. At this lower inlet loading, the scrubber must perform at its maximum efficiency to achieve outlet EtO concentrations low enough to demonstrate compliance.

During the first chamber evacuation of the exhaust phase, EtO emissions to the inlet of the AAT System were determined using the Ideal Gas Law and the chamber conditions at the beginning and at the end of the first chamber evacuation. During the first chamber evacuation of the exhaust phase, EtO emissions from the outlet of the AAT System were determined using direct source sample injection into the GC. During aeration testing, EtO emissions at the inlet and the outlet of the Safe Cell System were determined using direct source sample injection into a GC.

All exhaust phase testing was conducted during normal process load conditions, but with an empty sterilization chamber to facilitate the performance of multiple test runs. All aeration testing was performed during normal process load conditions, after freshly sterilized product had been transferred into an aeration chamber/room. The testing program was conducted in accordance with the procedures outlined in the following sections.

Operation and documentation of process conditions was performed by personnel from Sterigenics, Inc. using existing monitoring instruments installed by the manufacturer on the equipment to be tested. In accordance with the procedures established in USEPA CFR40, Part 63, Subpart O, scrubber liquor level was recorded.

5.2

VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the outlet of the scrubber was determined by 40 CFR 60, Appendix A, Method 2, using an s-type pitot tube and an inclined-oil manometer. Sampling ports were located in accordance with 40 CFR 60, Appendix A, Method 1. The test ports were located far enough from any flow disturbances to permit accurate flow measurement.

Temperature measurements were obtained from a type K thermocouple and thermometer attached to the sampling probe. Exhaust gas composition was assumed to be air and small amounts of water vapor. Water vapor was negligible and, based on previous test data, a value of 2 percent was used for flow calculations.

5.3

CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

During the first chamber evacuation of the sterilizer exhaust phase, the mass emissions of EtO vented to the inlet of the scrubber were determined using the procedures outlined in CFR40, Part 63.365. This method allows the determination of the mass of EtO vented to the inlet of the scrubber through calculations based on the Ideal Gas Law and using the conditions (pressure, temperature, volume) of the sterilization chamber immediately after it has been charged with sterilant gas, and upon conclusion of the first chamber evacuation of the exhaust phase.

The mass of EtO vented to the inlet of the scrubber during the first chamber evacuation of the exhaust phase was determined by calculating the mass of EtO present in the chamber after the first chamber evacuation and subtracting it from the mass of EtO present in the chamber after it has been charged with sterilant gas. The mass of EtO present in the chamber was calculated using Equation 1, shown below in Section 5.9.

During the first chamber evacuation of the sterilizer exhaust phase, EtO emissions from the outlet were determined using direct source sample injection into the GC. During the first chamber evacuation of the sterilizer exhaust phase, EtO emissions from the outlet were determined using direct source sample injection into the GC. During aeration, EtO emissions to the inlet and from the outlet were determined using direct source sample injection into the GC. The mass of EtO emitted from the outlet was determined using Equation 2, shown below in Section 5.9. Mass-mass control-efficiency of EtO during the sterilizer exhaust phase and aeration was calculated by comparing the mass of EtO vented to the system inlet to the mass of EtO vented from the system outlet.

During the sterilization chamber exhaust phase and aeration testing, vented gas was analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) was used to quantify emissions at the AAT System inlet, and a photoionization detector (PID) was used to quantify low-level EtO emissions at the AAT System outlet.

5.4 SAMPLE TRANSPORT

Source gas was pumped to the GC at approximately 500-1000 cubic centimeters per minute (cc/min) from the sampling ports through two lengths of Teflon® sample line, each with a nominal volume of approximately 75 cubic centimeters (cc) and an outer diameter of 0.25 inch. At the inlet of the Safe Cell System, the sampling port was located in the plenum immediately upstream packed tower scrubber. At the outlet of the Safe Cell System, sampling ports were located in the exhaust stack downstream of the dry bed reactors.

5.5 GC INJECTION

Source-gas samples were then injected into the GC which was equipped with two heated sampling loops, each containing a volume of approximately 2cc and maintained at 100 degrees Celsius (C). Injections occurred at approximately one-minute intervals during the sterilization chamber exhaust phase, and at approximately five-minute intervals during aeration testing. Helium was the carrier gas for both the FID and the PID.

5.6 GC CONDITIONS

The packed columns for the GC were both operated at 90 degrees C. The columns were stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh CarboPack B.

During the analysis, the FID was operated at 250 degrees C. The support gases for the FID were hydrogen (99.995% pure) and air (99.9999% pure). Any unused sample gas was vented from the GC system back to the inlet of the control device being tested.

5.7 CALIBRATION STANDARDS

The FID was calibrated for mid-range part-per-million-by-volume (ppmv) level analysis using gas proportions similar to the following:

- 1) 100 ppmv EtO, balance nitrogen
- 2) 50 ppmv EtO, balance nitrogen (audit gas)
- 3) 10 ppmv EtO, balance nitrogen
- 4) 1 ppmv EtO, balance nitrogen

The PID was calibrated for low-range ppmv level analyses using gas proportions similar to the following:

- 1) 100 ppmv EtO, balance nitrogen
- 2) 50 ppmv EtO, balance nitrogen (audit gas)
- 3) 10 ppmv EtO, balance nitrogen
- 4) 1 ppmv EtO, balance nitrogen

Each of these calibration standards was in a separate, certified manufacturer's cylinder. Copies of the calibration gas laboratory certificates are attached as Appendix I.

5.8 SAMPLING DURATION

Exhaust phase EtO measurements will be taken for the entire duration of the first chamber evacuation, which will be approximately 15-30 minutes. This will encompass a total sampling duration of approximately 15-30 minutes for each exhaust phase test run.

Since aeration is a 24-hour process at this facility, with constant discharge flow from the aeration chambers to the emission-control system, aeration testing will consist of a total of three 1-hour test runs. Each test run will be performed after freshly sterilized product has been transferred into an aeration room.

5.9 CONTROL-EFFICIENCY/MASS-EMISSIONS CALCULATIONS

The following equation was used to calculate mass of EtO discharged to the inlet of the emission-control system during the first chamber evacuation of the sterilizer exhaust phase:

EQUATION 1:

$$W_c = W_{ci} - W_{cf}$$

Where:

W_c = Weight of EtO discharged from the sterilization chamber to the emission-control system during the first chamber evacuation, pounds

$$W_{ci} = (mw)(p)(P)(V)/(R)(T)$$

(and W_{cf})

Where:

W_{ci} = Weight of EtO present in the sterilization chamber before the first chamber evacuation, pounds

W_{cf} = Weight of EtO present in the sterilization chamber after the first chamber evacuation, pounds

MW = Molecular weight of EtO, 44.05 lb/mol

p = Percent of EtO in chamber

$$= W_s/W_i$$

Where:

W_s = Scale-measured weight of EtO charged into sterilization chamber

W_i = Calculated weight of EtO charged into sterilization chamber (@ 100%)

P = Sterilization chamber pressure (after charging/at the end of the 1st evac), psia

V = Sterilization chamber volume, ft³

R = Gas constant, 10.73 psia·ft³/mol·°R

T = Sterilization chamber temperature (after charging/at the end of the 1st evac), °R

Note: Standard conditions are 68°F and 1 atm.

Mass emissions of EtO during exhaust and aeration will be calculated using the following equation:

EQUATION 2:

$$\text{MassRate} = (\text{VolFlow})(\text{MolWt})(\text{ppmv EtO}/10^6)/(\text{MolVol})$$

Where:

MassRate = EtO mass flow rate, pounds per minute

VolFlow	=	Corrected volumetric flow rate, standard cubic feet per minute at 68 degrees F
MolWt	=	44.05 pounds EtO per pound mole
ppmv EtO	=	EtO concentration, parts per million by volume
10^6	=	Conversion factor, ppmv per "cubic foot per cubic foot"
MolVol	=	385.32 cubic feet per pound mole at one atmosphere and 68 degrees F

Results of the control-efficiency testing are presented in Section 8.0 and in Tables 1 and 2.

6.0 TEST SCENARIO

During exhaust phase testing, each sterilizer was tested during normal process load conditions, but with an empty sterilization chamber to facilitate the performance of multiple test runs. All aeration testing was performed during normal process load conditions, after freshly sterilized product had been transferred into an aeration chamber/room. A total of three exhaust-phase and three aeration test runs were performed to verify the performance of the emission-control device. Testing was conducted with an effort to offer minimal disruption to the Sterigenics production schedule. The testing schedule was as follows:

- 1) Testing equipment was set up and calibrated.
- 2) Aeration Test Run #1 was performed with freshly sterilized product transferred into aeration. Sampling was performed at the inlet and outlet of the AAT System.
- 3) Aeration Test Run #2 was performed with freshly sterilized product transferred into aeration. Sampling was performed at the inlet and outlet of the AAT System.
- 4) Aeration Test Run #3 was performed with freshly sterilized product transferred into aeration. Sampling was performed at the inlet and outlet of the AAT System.
- 5) An empty-chamber cycle was started in one of the sterilizers.
- 6) Exhaust Phase Test Run #1 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the AAT System.
- 7) An empty-chamber cycle was started in one of the sterilizers.
- 8) Exhaust Phase Test Run #2 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the AAT System.
- 9) An empty-chamber cycle was started in one of the sterilizers.
- 10) Exhaust Phase Test Run #3 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the AAT System.
- 11) Post calibration check was performed, testing equipment was packed.

7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system was leak checked at a vacuum of 15 inches of mercury. The sampling system was considered leak free when the flow indicated by the rotameters fell to zero.

At the beginning of the test, a system blank was analyzed to ensure that the sampling system was free of EtO. Ambient air was introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also provided a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device, and due to the destruction of EtO by the emission-control device which produces carbon dioxide and water vapor. This chromatogram, designated AMB, is included with the calibration data in Appendix A.

7.2 CALIBRATION PROCEDURES

The GC system was calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a point-to-point calibration curve was constructed for each detector. A gas cylinder of similar composition as the calibration gases, but certified by a separate supplier, was used to verify calibration gas composition and GC performance.

All calibration gases and support gases used were of the highest purity and quality available. A copy of the laboratory certification for each calibration gas is attached as Appendix I.

8.0 TEST RESULTS

The AAT Safe Cell System demonstrated an EtO control efficiency of 99.96 percent for aeration, and 99.94 percent for exhaust. In accordance with EPA requirements, as specified in the IEPA Air Quality Permit, this control equipment must have an EtO control efficiency of 99 percent or more in control of emissions from exhaust and from aeration. The AAT Safe Cell System met this requirement.

The test results are summarized in Table 1 and 2. This table includes results for EtO control efficiency of the emission-control device. Chromatograms and chromatographic supporting data are attached as Appendices A through G. Copies of field data and calculation worksheets are attached as Appendix H.

TABLES

TABLE 1
ETHYLENE OXIDE CONTROL EFFICIENCY - AERATION
OF AN AAT SAFE CELL EMISSION CONTROL DEVICE
OPERATED BY STERIGENICS, INC.
IN WILLOWBROOK, ILLINOIS (PLANT 2)
ON DECEMBER 13, 2016

RUN NUMBER	INJECTION TIME	INLET ETO CONC. (PPM)(1)	OUTLET ETO CONC. (PPM)(2)	ETO CONTROL EFFICIENCY
1(3)	1000	25.7	0.01	99.9611
1	1005	25.5	0.01	99.9608
1	1010	25.9	0.01	99.9614
1	1015	23.5	0.01	99.9574
1	1020	25.8	0.01	99.9612
1	1025	25.7	0.01	99.9611
1	1030	25.7	0.01	99.9611
1	1035	25.5	0.01	99.9608
1	1040	25.5	0.01	99.9608
1	1045	25.5	0.01	99.9608
1	1050	25.2	0.01	99.9603
1	1055	25.0	0.01	99.9600
2(4)	1100	25.0	0.01	99.9600
2	1105	25.4	0.01	99.9606
2	1110	25.8	0.01	99.9612
2	1115	25.8	0.01	99.9612
2	1120	25.8	0.01	99.9612
2	1125	25.4	0.01	99.9606
2	1130	25.4	0.01	99.9606
2	1135	25.4	0.01	99.9606
2	1140	24.8	0.01	99.9597
2	1145	25.5	0.01	99.9608
2	1150	25.1	0.01	99.9602
2	1155	24.9	0.01	99.9598
3(5)	1534	22.3	0.01	99.9552
3	1539	22.7	0.01	99.9559
3	1544	23.1	0.01	99.9567
3	1549	23.2	0.01	99.9569
3	1554	23.5	0.01	99.9574
3	1559	23.4	0.01	99.9573
3	1604	23.6	0.01	99.9576
3	1609	23.8	0.01	99.9580
3	1614	23.8	0.01	99.9580
3	1619	23.8	0.01	99.9580
3	1624	23.8	0.01	99.9580
3	1629	<u>24.1</u>	<u>0.01</u>	<u>99.9585</u>
TIME-WEIGHTED AVERAGE:		24.72	0.0100	99.9595
NYDEQ REQUIRED CONTROL EFFICIENCY:				99%

Notes:

- (1) - PPM = parts per million by volume
- (2) - 0.01 ppm is the quantification limit for the detector used at the outlet.
- (3) - Aeration Phase Test Run #1 started at 09:57, ended at 10:57.
- (4) - Aeration Phase Test Run #2 started at 10:57, ended at 11:57.
- (5) - Aeration Phase Test Run #3 started at 15:32, ended at 16:32.

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TABLE 2
ETHYLENE OXIDE CONTROL EFFICIENCY - EXHAUST
OF AN AAT SAFE CELL EMISSION CONTROL DEVICE
OPERATED BY STERIGENICS, INC.
IN WILLOWBROOK, ILLINOIS (PLANT 2)
DECEMBER 13, 2016

<u>Run #</u>	<u>Stack Flow (dscfm) (2)</u>	<u>Average Outlet Conc. (ppm) (1)</u>	<u>Outlet EtO Mass Flow (lbs/min) (3)</u>	<u>Minutes/ Cycle</u>	<u>Outlet EtO Mass Emissions (lbs)</u>	<u>Inlet EtO Mass Emissions (lbs)</u>	<u>EtO Control Efficiency (%)</u>
#1	10400	1.547	0.0018416	12	0.000221	49.8	99.96
#2	10400	1.956	0.0023275	11	0.0002560	49.8	99.95
#3	10400	3.536	0.0042081	9	0.0003787	48.9	99.92
Average EtO Control Efficiency:							99.94
Required EtO Control Efficiency:							99

Notes: (1) - PPM = parts per million by volume

(2) - DSCFM = dry standard cubic feet per minute

(3) - LBS/MIN = EtO emissions, pounds per minute

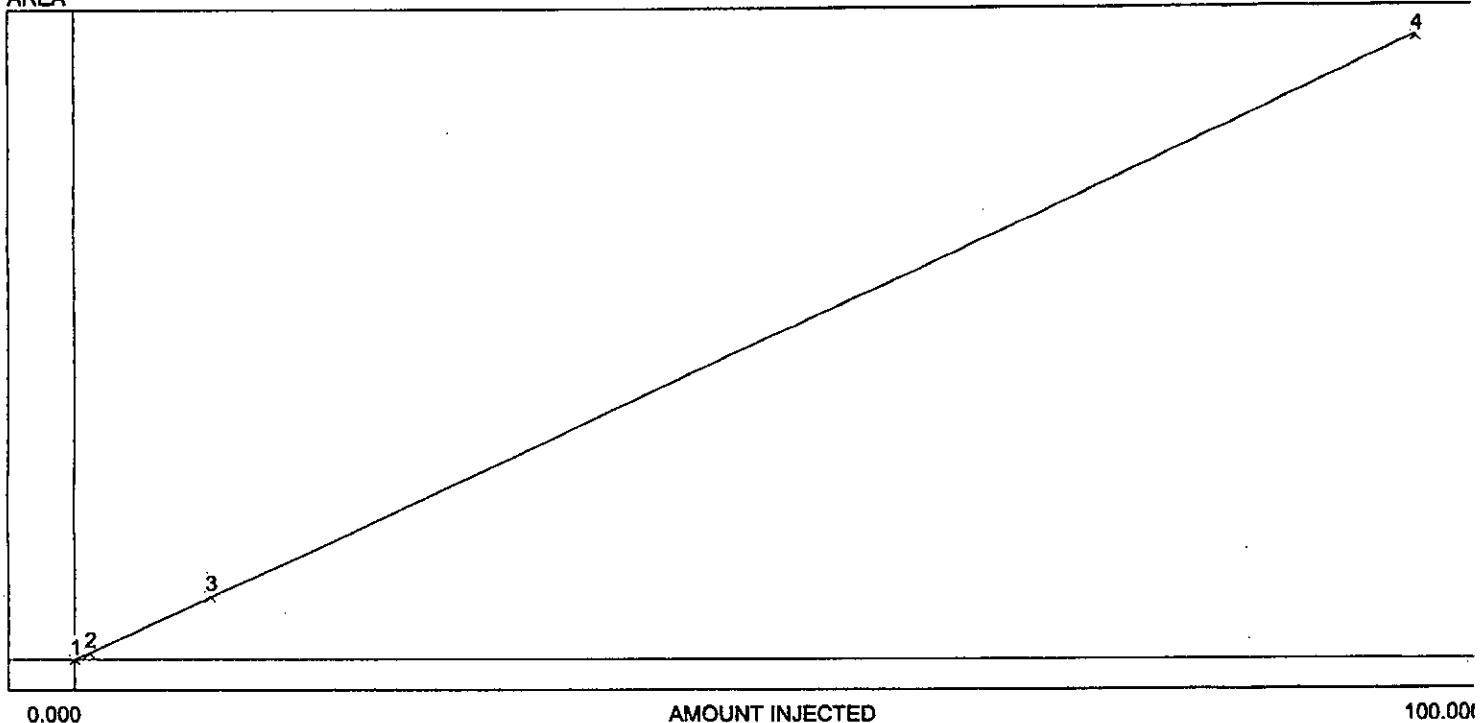
APPENDICES

APPENDIX A

Calibration Data

ak	Name	Start	End	Calibration	Int.Std	Units
	Dead Vol / Air	0.000	0.350		0.000	
	Ambient H2O	0.350	0.500		0.000	
	Ethylene Oxide	0.500	0.600	C:\peak359\1Ster	0.000	16.ppm
	Acetaldehyde	0.600	0.800		0.000	
	CO2	0.800	1.000		0.000	

AREA



slope of curve: 0.43

x axis intercept: 0.00

earity: 1.00

mber of levels: 4

/rel SD of CF's: 0.2/66.7

0.4316X

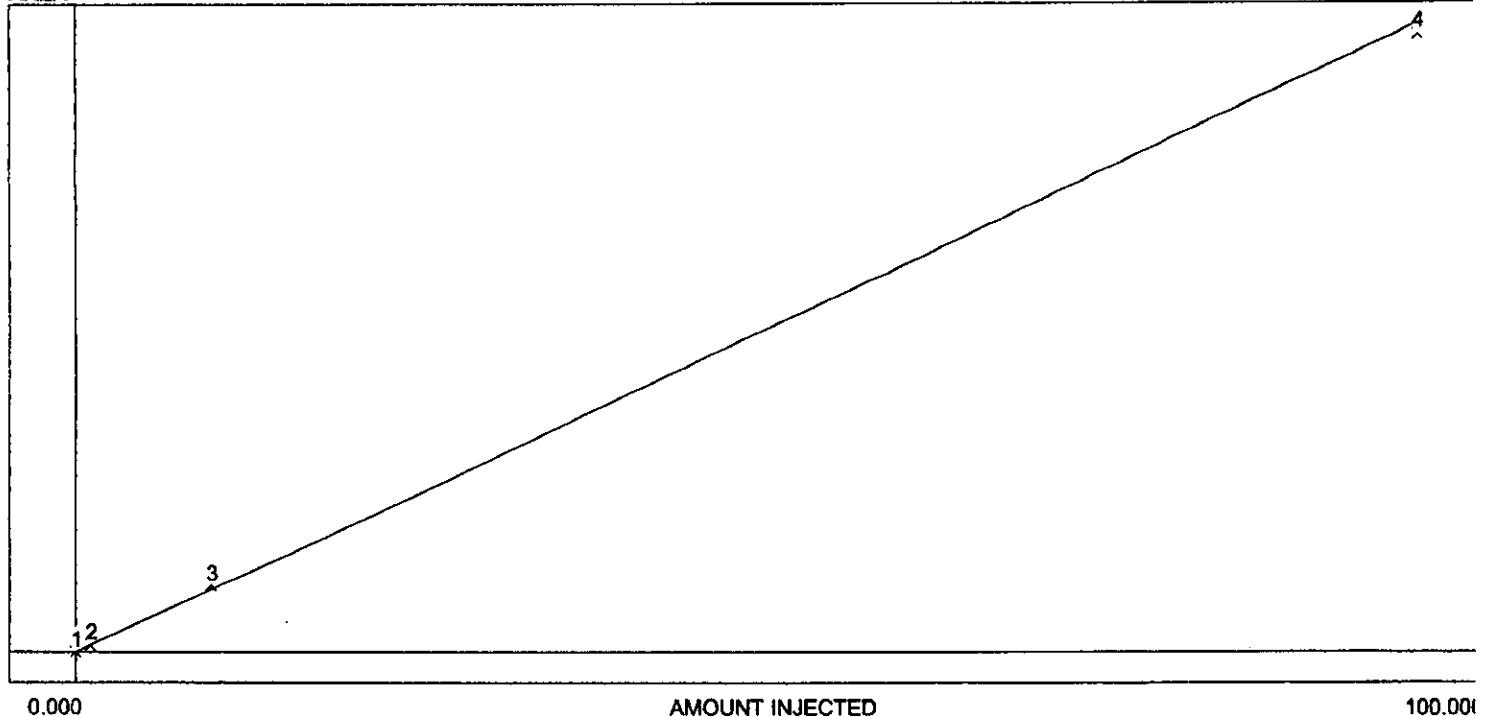
1.0000

st calibrated: Fri Dec 02 08:01:11 2016

Area/ht.	Amount	CF	Current	Previous #1	Previous #2
0.000	0.000	0.000	0.000	N/A	N/A
0.470	1.100	0.427	0.470	N/A	N/A
4.420	10.100	0.438	4.420	N/A	N/A
43.000	100.000	0.430	43.000	N/A	N/A

ak	Name	Start	End	Calibration	Int.Std	Units
	Dead Vol / Air	0.000	0.350		0.000	
	Ambient H2O	0.350	0.500		0.000	
	Ethylene Oxide	0.500	0.600	C:\peak359\2Ster	0.00016	ppm
	Acetaldehyde	0.600	0.800		0.000	
	CO2	0.800	1.000		0.000	

AREA



slope of curve: 1.82

axis intercept: 0.00

earity: 1.00

nber of levels: 4

/rel SD of CF's: 0.9/67.0

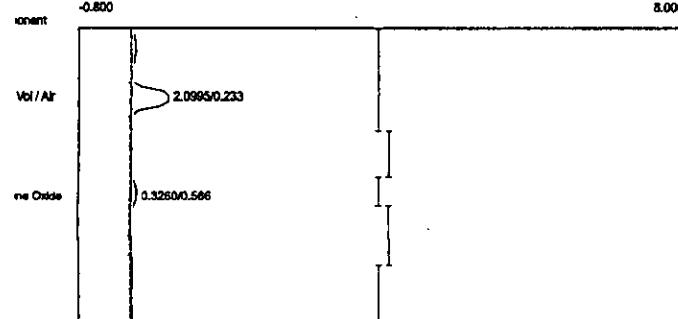
1.8223X

0.9999

it calibrated: Fri Dec 02 08:00:23 2016

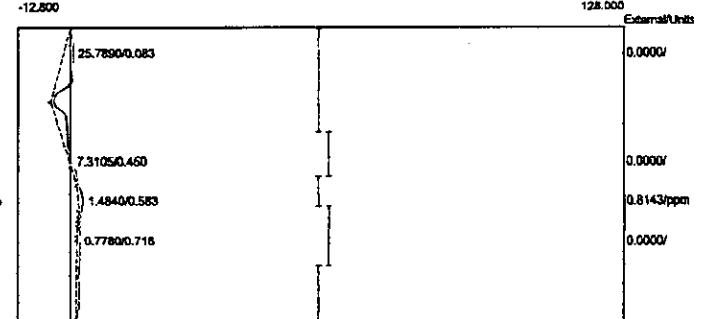
Area/ht.	Amount	CF	Current	Previous #1	Previous #2
0.000	0.000	0.000	0.000	N/A	N/A
1.910	1.100	1.736	1.910	N/A	N/A
19.600	10.100	1.941	19.600	N/A	N/A
179.000	100.000	1.790	179.000	N/A	N/A

Client: Sterigenics - Willowbrook 2
 Client ID: PreCal
 Analysis date: 12/13/2016 11:35:08
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-Amb.CHR (c:\peak359)
 Sample: Ambient Background
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.0995	0.0000	
Ethylene Oxide	0.566	0.3260	0.7553 ppm	
		2.4255	0.7553	

Client: Sterigenics - Willowbrook 2
 Client ID: PreCal
 Analysis date: 12/13/2016 11:35:08
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-Amb.CHR (c:\peak359)
 Sample: Ambient Background
 Operator: D. Kremer

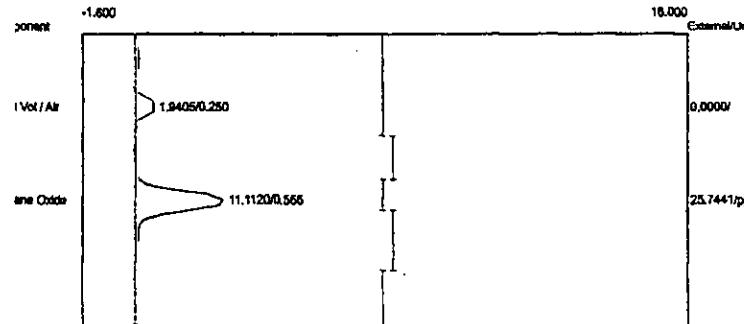


Component	Retention	Area	External	Units
Dead Vol / Air	0.083	25.7890	0.0000	
Ambient H2O	0.450	7.3105	0.0000	
Ethylene Oxide	0.583	1.4840	0.8143 ppm	
Acetaldehyde	0.716	0.7780	0.0000	
		35.3615	0.8143	

APPENDIX B

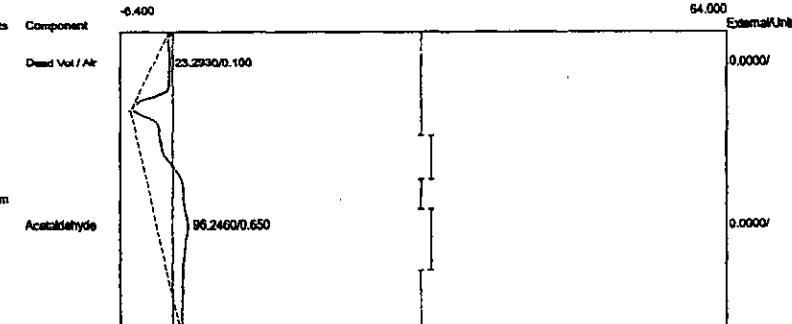
Run#1 Chromatograms - Aeration

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:00:05
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A01.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



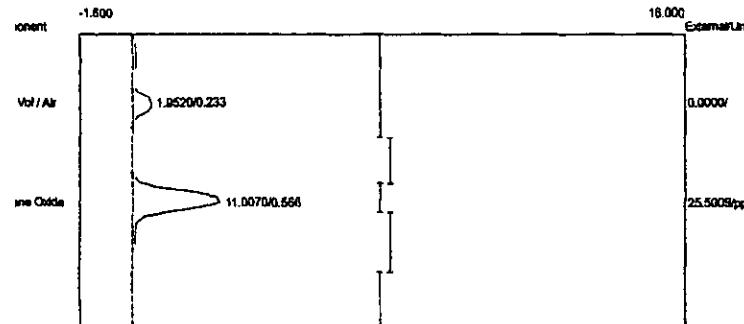
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9405	0.0000	
Ethylene Oxide	0.566	11.1120	25.7441	ppm
		13.0525	25.7441	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:00:05
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A01.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



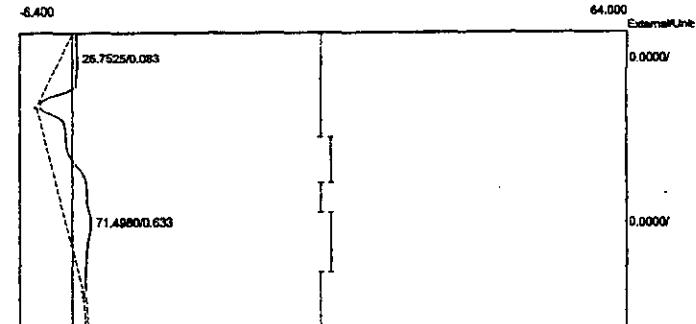
Component	Retention	Area	External	Units
Dead Vol / Air	0.100	23.2930	0.0000	
Acetaldehyde	0.650	96.2460	0.0000	
		119.5390	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:05:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A02.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



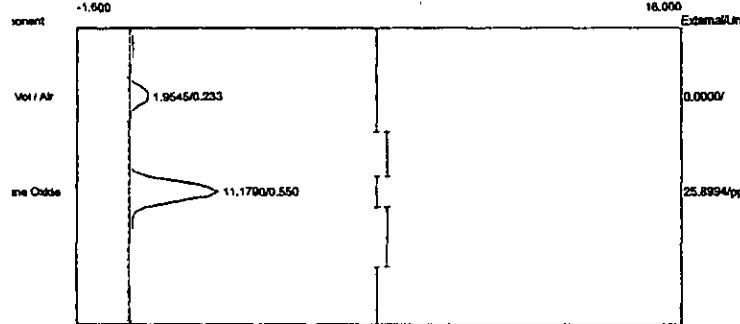
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9520	0.0000	
Ethylene Oxide	0.566	11.0070	25.5009 ppm	
		12.9590	25.5009	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:05:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A02.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



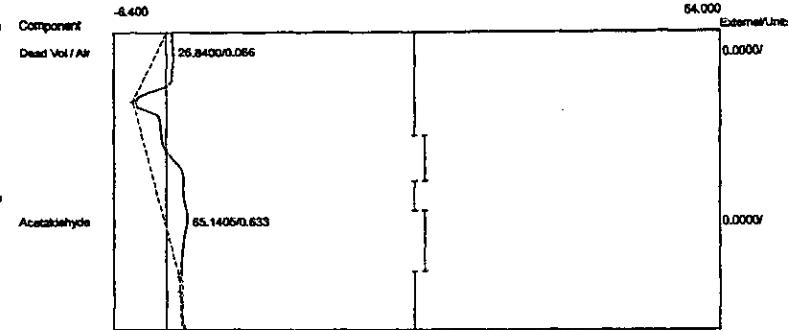
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	26.7525	0.0000	
Acetaldehyde	0.633	71.4980	0.0000	
		98.2505	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:10:08
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A03.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9545	0.0000	
Ethylene Oxide	0.550	11.1790	25.8994 ppm	
	13.1335	25.8994		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:10:08
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A03.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	26.8400	0.0000	
Acetaldehyde	0.633	65.1405	0.0000	
	91.9805	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Aer

Analysis date: 12/13/2016 10:15:21

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-1A04.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Aer

Analysis date: 12/13/2016 10:15:21

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

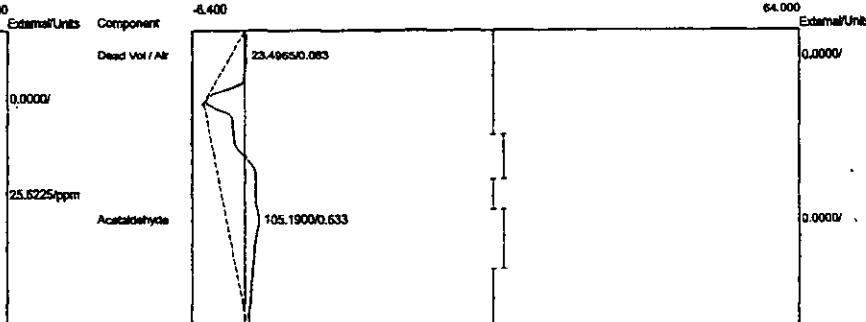
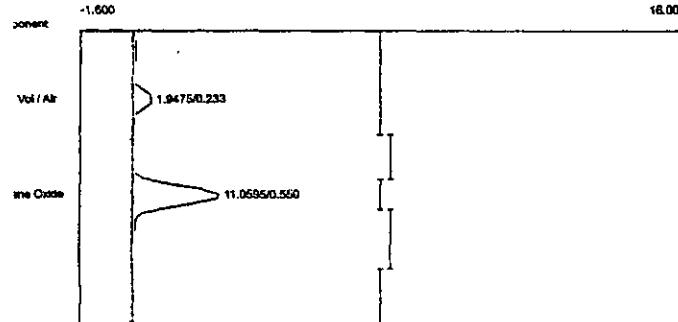
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1A04.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9475	0.0000	
Ethylene Oxide	0.550	11.0595	25.6225 ppm	
	13.0070	25.6225		

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	23.4965	0.0000	
Acetaldehyde	0.633	105.1900	0.0000	
	128.6865	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Aer

Analysis date: 12/13/2016 10:20:42

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-1A05.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Aer

Analysis date: 12/13/2016 10:20:42

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

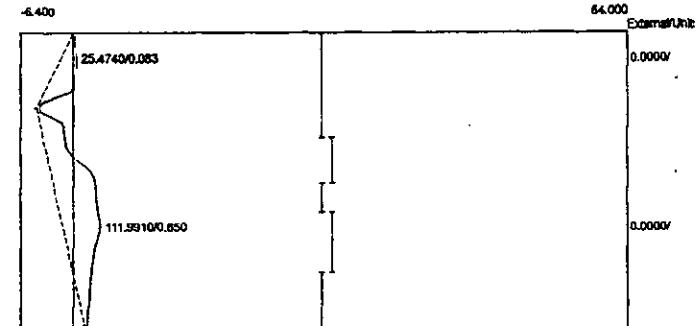
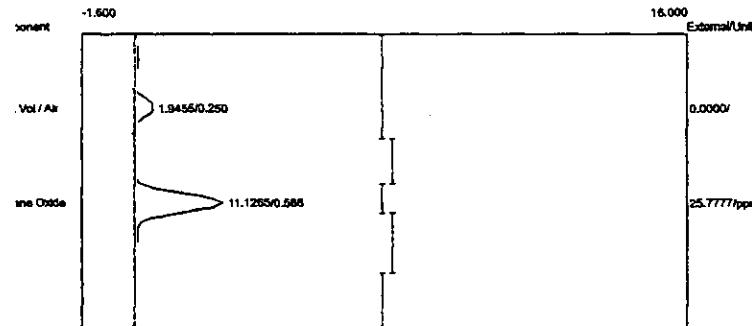
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1A05.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



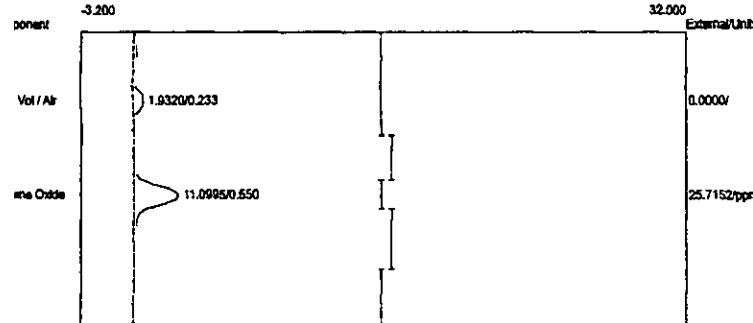
Component	Retention	Area	External	Units
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Dead Vol / Air	0.250	1.9455	0.0000	
Ethylene Oxide	0.566	11.1265	25.7777 ppm	
	13.0720	25.7777		

Component	Retention	Area	External	Units
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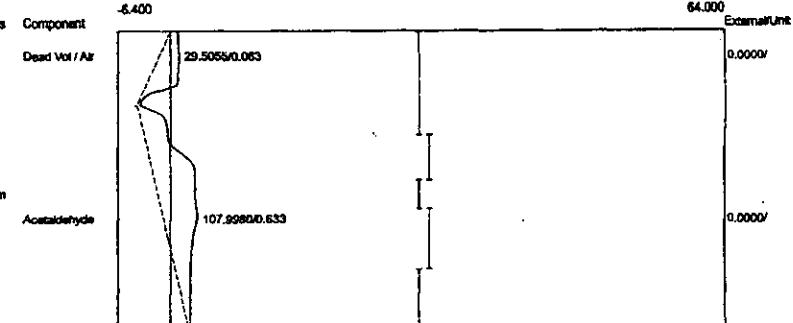
Dead Vol / Air	0.083	25.4740	0.0000	
Acetaldehyde	0.650	111.9910	0.0000	
	137.4650	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:25:04
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A06.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



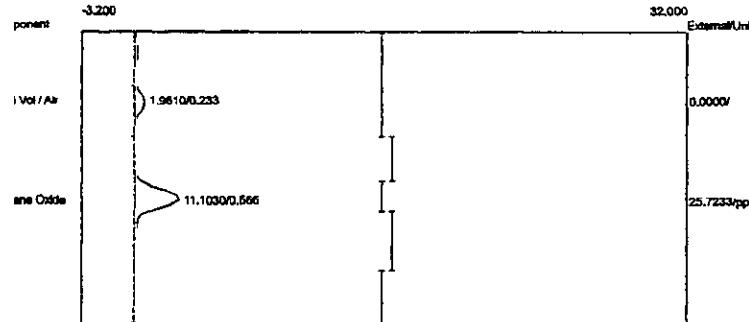
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9320	0.0000	
Ethylene Oxide	0.550	11.0995	25.7152	ppm
	13.0315	25.7152		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:25:04
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A06.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



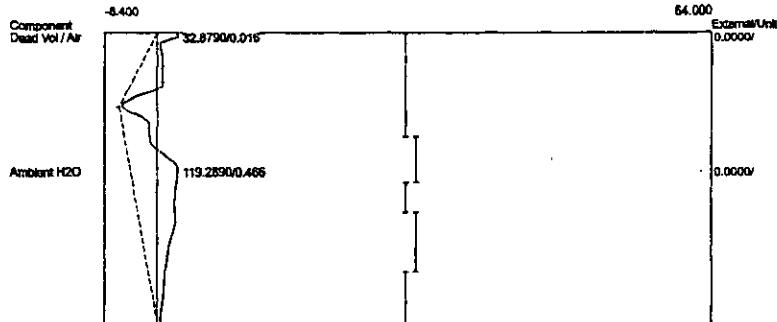
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	29.5055	0.0000	
Acetaldehyde	0.633	107.9980	0.0000	
	137.5035	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:30:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPak B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A07.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



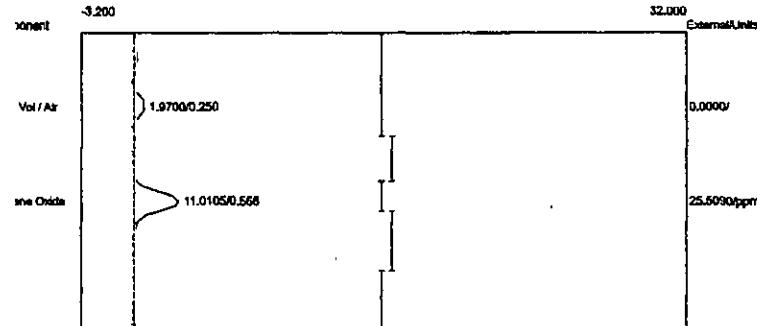
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9610	0.0000	
Ethylene Oxide	0.566	11.1030	25.7233	ppm
	13.0640	25.7233		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:30:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPak B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A07.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



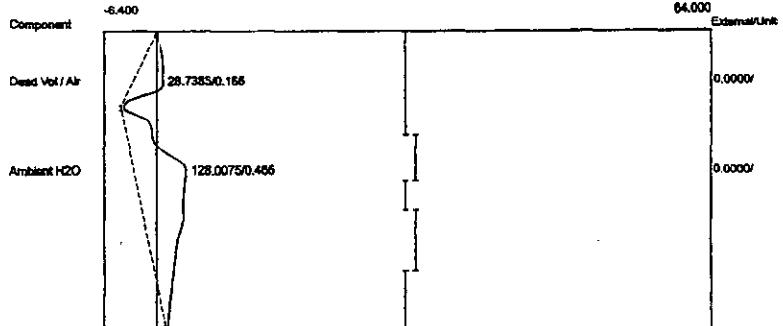
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	32.8790	0.0000	
Ambient H2O	0.466	119.2890	0.0000	
		152.1680	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:35:17
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A08.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



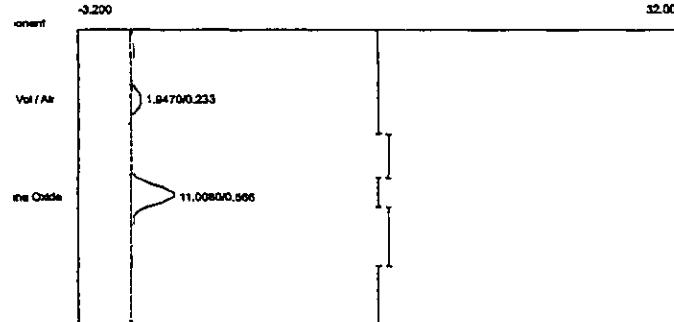
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9700	0.0000	
Ethylene Oxide	0.566	11.0105	25.5090	ppm
		12.9805	25.5090	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:35:17
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A08.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



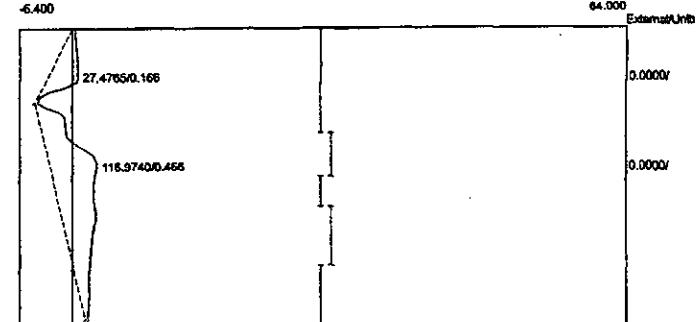
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	28.7385	0.0000	
Ambient H2O	0.466	128.0075	0.0000	
		156.7460	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:40:15
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A09.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



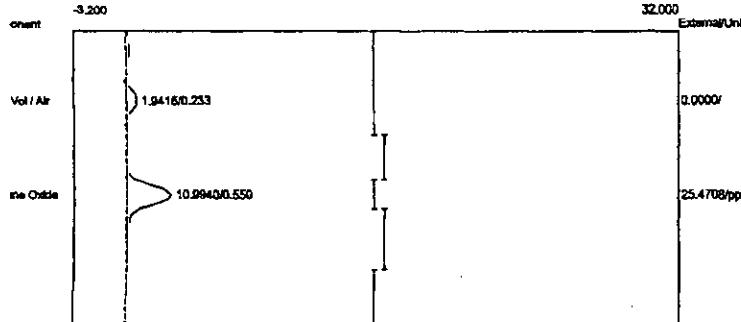
Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9470	0.0000	
Ethylene Oxide	0.566	11.0080	25.5032 ppm	
	12.9550	25.5032		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:40:15
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A09.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



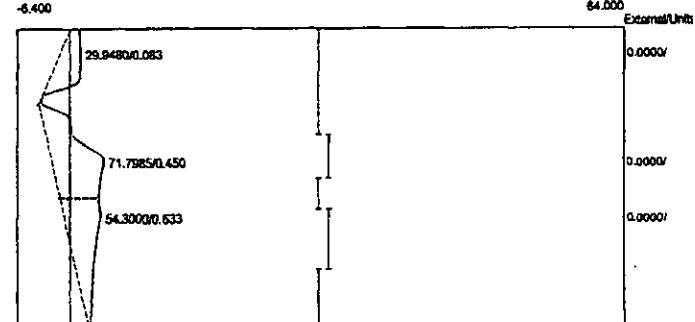
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	27.4765	0.0000	
Ambient H2O	0.466	116.9740	0.0000	
	144.4505	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:45:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A10.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9415	0.0000	
Ethylene Oxide	0.550	10.9940	25.4708 ppm	
	12.9355	25.4708		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:45:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A10.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	29.9480	0.0000	
Ambient H2O	0.450	71.7985	0.0000	
Acetaldehyde	0.633	54.3000	0.0000	
		156.0465	0.0000	

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Aer

Analysis date: 12/13/2016 10:50:16

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-1A11.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Aer

Analysis date: 12/13/2016 10:50:16

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

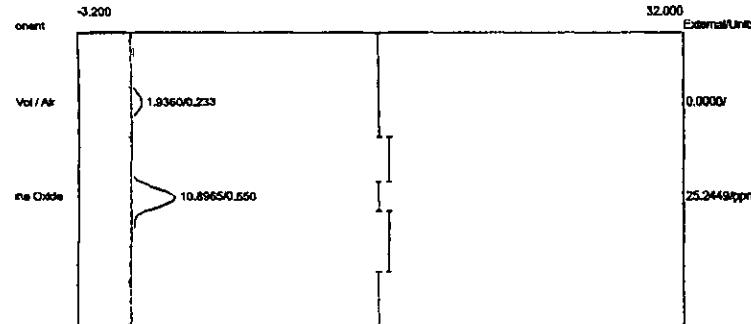
Temp. prog: eto-100.tem

Components: eto2-100.cpt

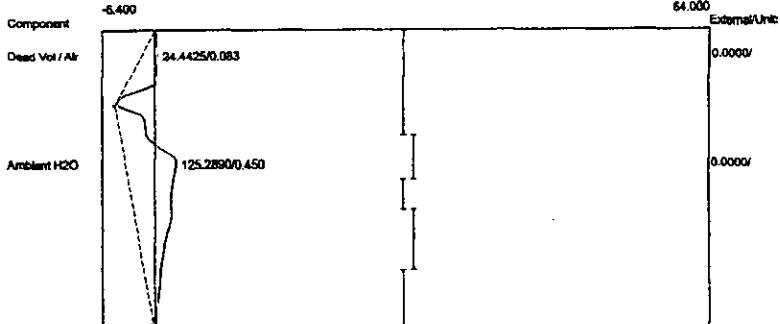
Data file: 2Ster2WB2016-1A11.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer

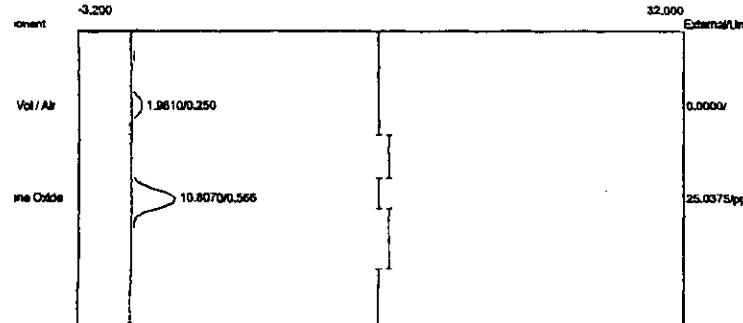


Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9360	0.0000	
ethylene Oxide	0.550	10.8965	25.2449	ppm
	12.8325	25.2449		



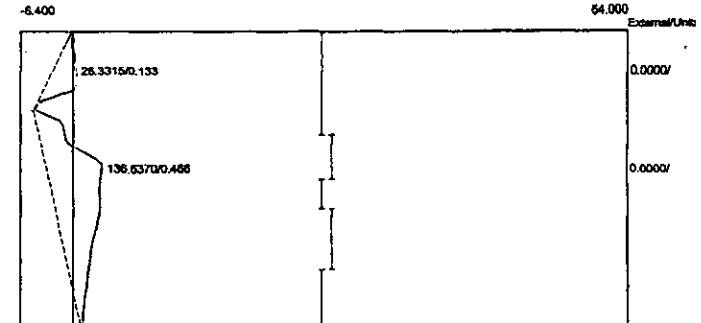
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	24.4425	0.0000	
Ambient H2O	0.450	125.2890	0.0000	
	149.7315	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:55:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-1A12.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.250	1.9610	0.0000	
Ethylene Oxide	0.566	10.8070	25.0375 ppm	
		12.7680	25.0375	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#1Aer
 Analysis date: 12/13/2016 10:55:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-1A12.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.133	26.3315	0.0000	
Ambient H2O	0.466	136.6370	0.0000	
		162.9685	0.0000	

APPENDIX C

Run#2 Chromatograms - Aeration

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Aer

Analysis date: 12/13/2016 11:00:05

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-2A01.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Aer

Analysis date: 12/13/2016 11:00:05

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

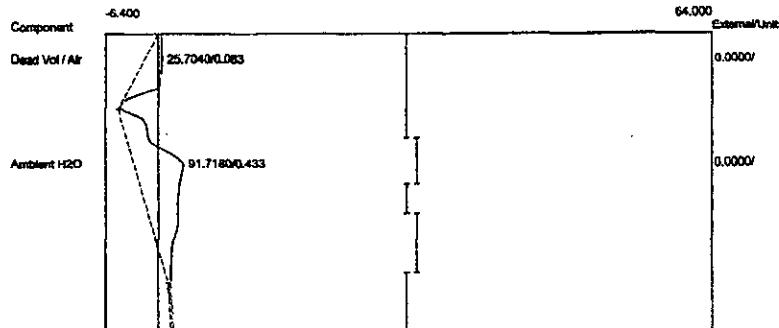
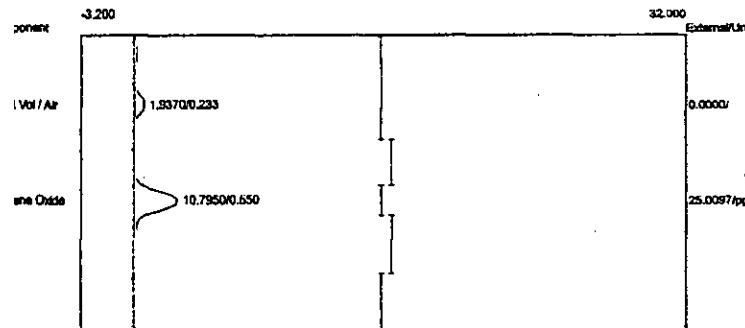
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2A01.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

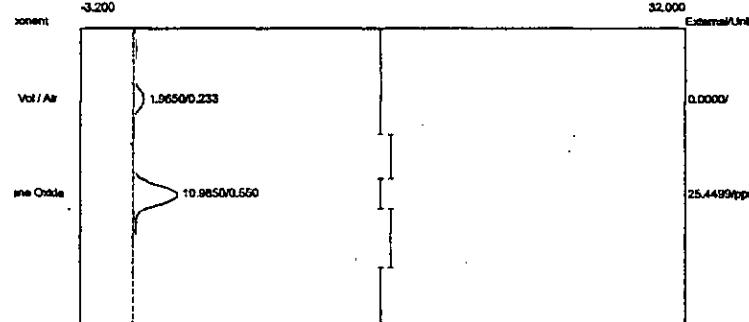
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9370	0.0000	
Ethylene Oxide	0.550	10.7950	25.0097	ppm
	12.7320	25.0097		

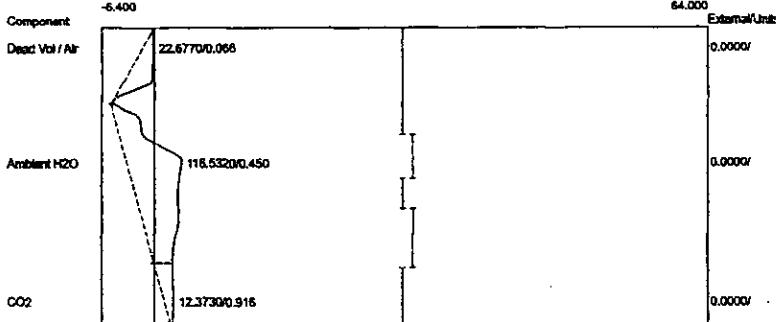
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	25.7040	0.0000	
Ambient H2O	0.433	91.7180	0.0000	
	117.4220	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:05:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A02.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



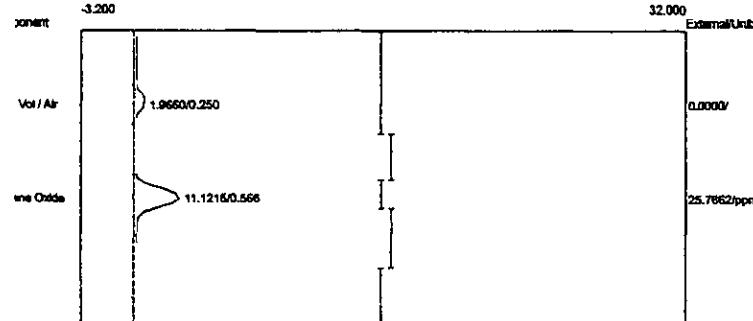
Component	Retention	Area	External	Units
Ethylene Oxide	0.233	1.9650	0.0000	
Ethylene Oxide	0.550	10.9850	25.4499	ppm
	12.9500	25.4499		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:05:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A02.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



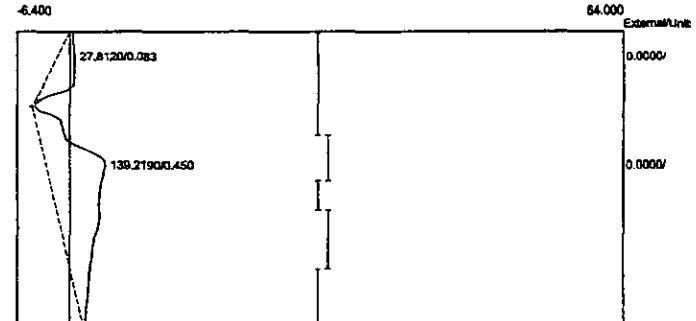
Component	Retention	Area	External	Units
Dead Vol / Air	0.066	22.6770	0.0000	
Ambient H2O	0.450	116.5320	0.0000	
CO2	0.916	12.3730	0.0000	
	151.5820	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:10:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A03.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



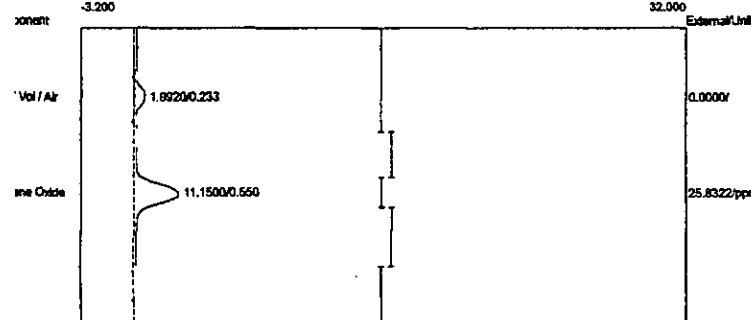
Component	Retention	Area	External	Units
Vol / Air	0.250	1.9660	0.0000	
Ethylene Oxide	0.566	11.1215	25.7662	ppm
	13.0875	25.7662		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:10:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A03.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



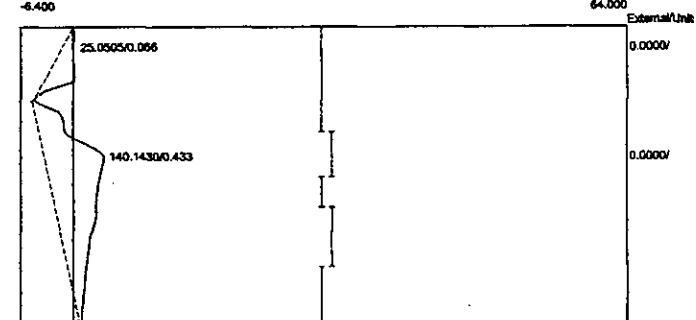
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	27.8120	0.0000	
Ambient H2O	0.450	139.2190	0.0000	
	167.0310	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:15:17
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A04.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



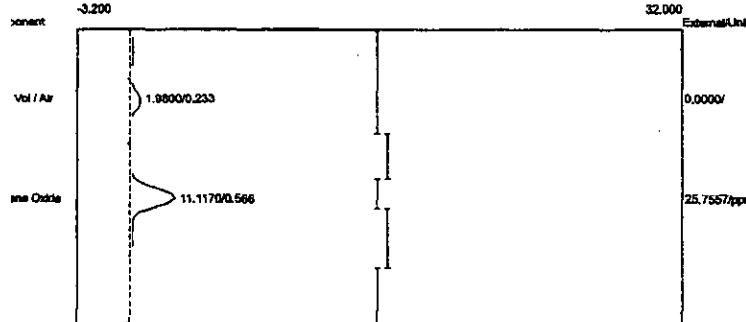
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9920	0.0000	
Ethylene Oxide	0.550	11.1500	25.8322	ppm
	13.1420	25.8322		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:15:17
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A04.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



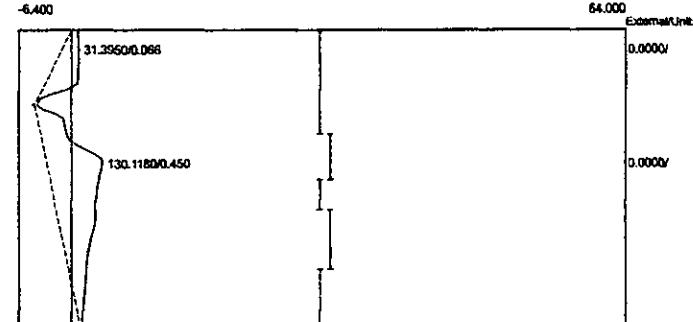
Component	Retention	Area	External	Units
Dead Vol / Air	0.066	25.0505	0.0000	
Ambient H2O	0.433	140.1430	0.0000	
	165.1935	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:20:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A05.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9800	0.0000	
Ethylene Oxide	0.566	11.1170	25.7557	ppm
	13.0970	25.7557		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:20:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A05.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	31.3950	0.0000	
Ambient H2O	0.450	130.1180	0.0000	
	161.5130	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Aer

Analysis date: 12/13/2016 11:25:14

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-2A06.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Aer

Analysis date: 12/13/2016 11:25:14

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

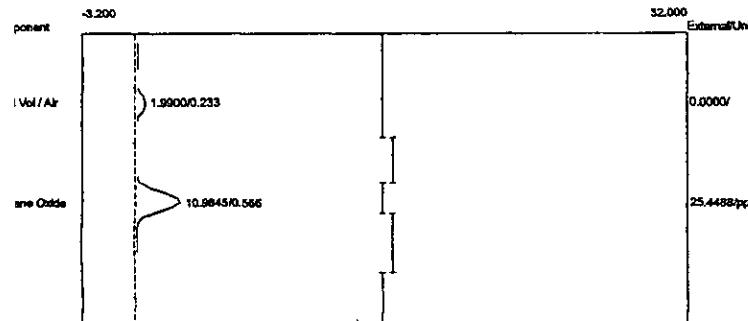
Temp. prog: eto-100.tem

Components: eto2-100.cpt

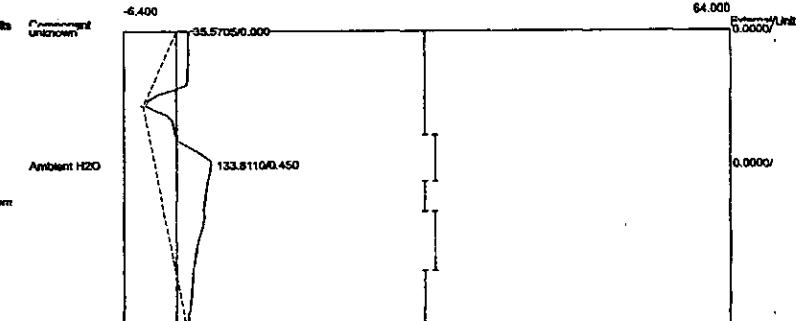
Data file: 2Ster2WB2016-2A06.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer

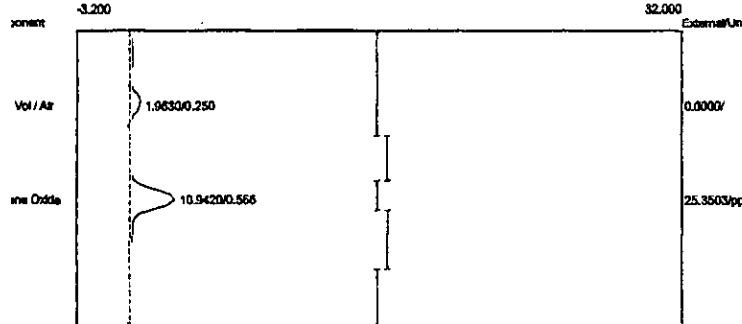


Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9900	0.0000	
Ethylene Oxide	0.566	10.9845	25.4488 ppm	
		12.9745	25.4488	



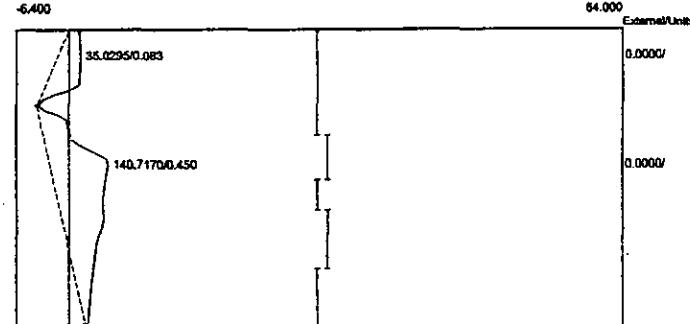
Component	Retention	Area	External	Units
Ambient H2O	0.450	133.8110	0.0000	
		133.8110	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:30:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A07.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



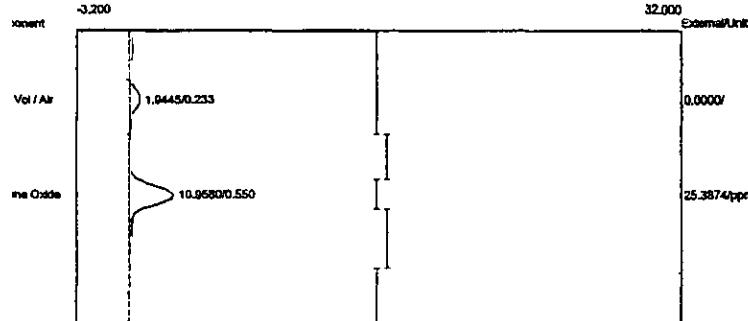
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9630	0.0000	
Ethylene Oxide	0.566	10.9420	25.3503	ppm
		12.9050	25.3503	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:30:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A07.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



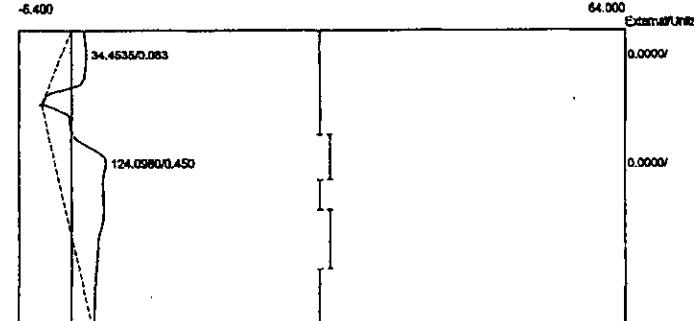
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	35.0295	0.0000	
Ambient H2O	0.450	140.7170	0.0000	
		175.7465	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:35:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A08.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9445	0.0000	
Ethylene Oxide	0.550	10.9580	25.3874 ppm	
	12.9025	25.3874		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:35:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A08.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	34.4535	0.0000	
Ambient H2O	0.450	124.0980	0.0000	
	158.5515	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Aer

Analysis date: 12/13/2016 11:40:26

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-2A09.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Aer

Analysis date: 12/13/2016 11:40:26

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

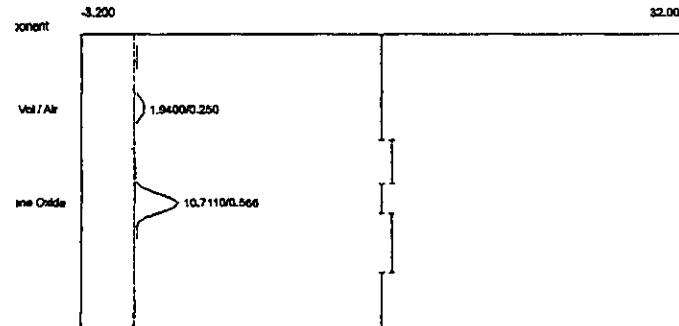
Temp. prog: eto-100.tem

Components: eto2-100.cpt

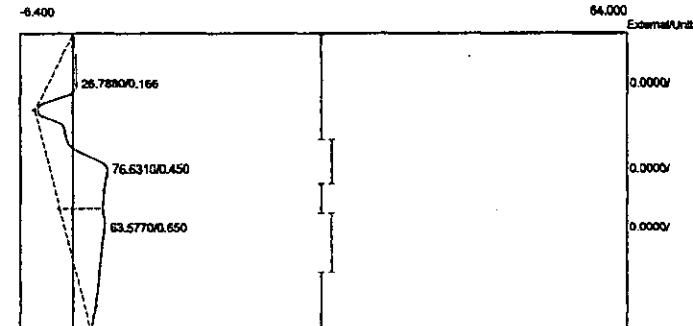
Data file: 2Ster2WB2016-2A09.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer

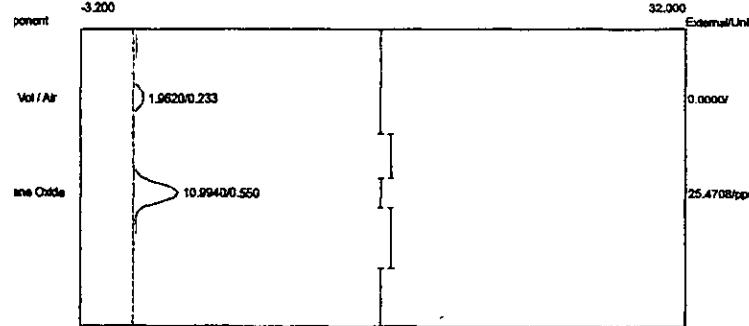


Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9400	0.0000	
Ethylene Oxide	0.566	10.7110	24.8151 ppm	
	12.6510	24.8151		



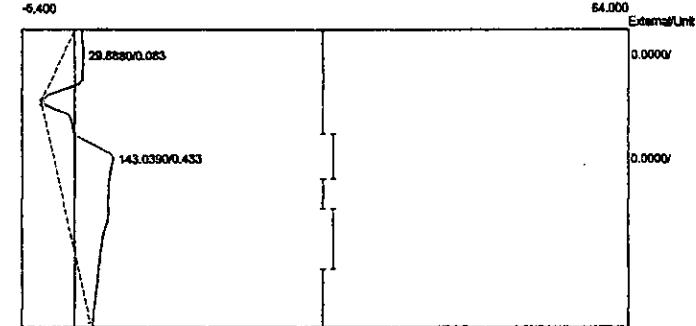
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	26.7880	0.0000	
Ambient H2O	0.450	76.6310	0.0000	
Acetaldehyde	0.650	63.5770	0.0000	
	166.9960	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:45:15
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A10.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



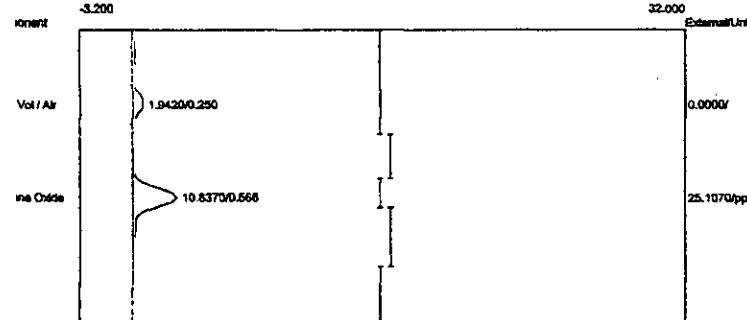
Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9620	0.0000	
Ethylene Oxide	0.550	10.9940	25.4708 ppm	
	12.9560	25.4708		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:45:15
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A10.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



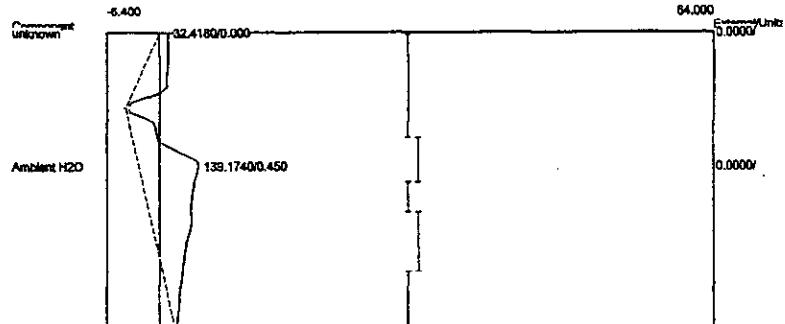
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	29.8880	0.0000	
Ambient H2O	0.433	143.0390	0.0000	
	172.9270	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:50:13
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A11.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



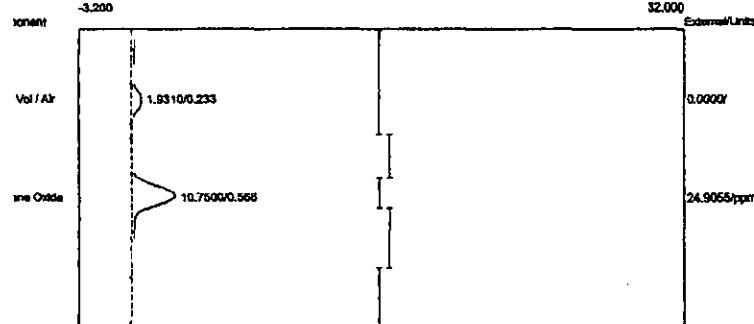
Component	Retention	Area	External	Units
Vol / Air	0.250	1.9420	0.0000	
Ethylene Oxide	0.566	10.8370	25.1070	ppm
	12.7790	25.1070		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:50:13
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A11.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



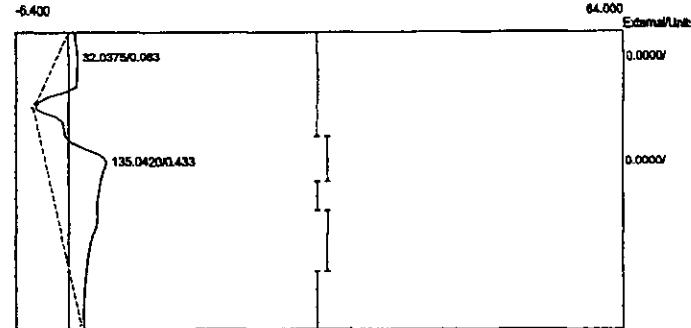
Component	Retention	Area	External	Units
Ambient H2O	0.450	139.1740	0.0000	
	139.1740	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:55:04
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-2A12.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9310	0.0000	
Ethylene Oxide	0.566	10.7500	24.9055 ppm	
		12.6810	24.9055	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#2Aer
 Analysis date: 12/13/2016 11:55:04
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-2A12.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	32.0375	0.0000	
Ambient H2O	0.433	135.0420	0.0000	
		167.0795	0.0000	

APPENDIX D

Run#3 Chromatograms - Aeration

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 15:34:55

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-3A01.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 15:34:55

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

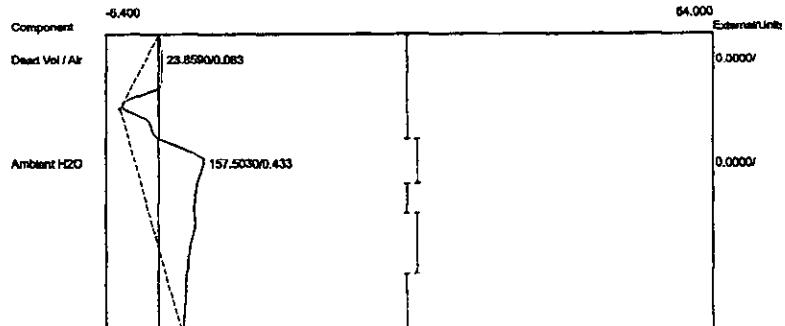
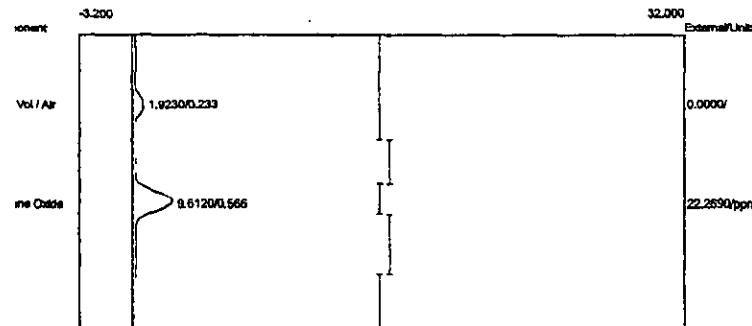
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3A01.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

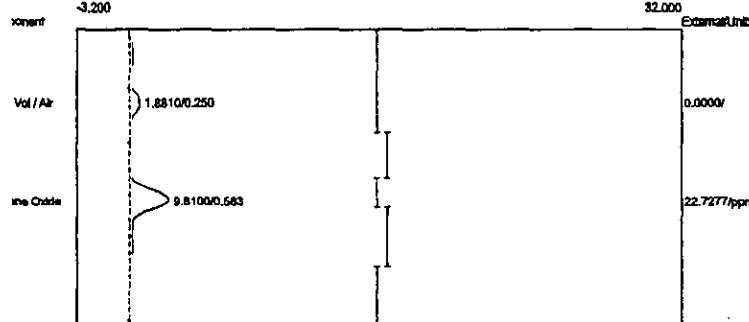
Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9230	0.0000	
ethylene Oxide	0.566	9.6120	22.2690 ppm	
	11.5350	22.2690		

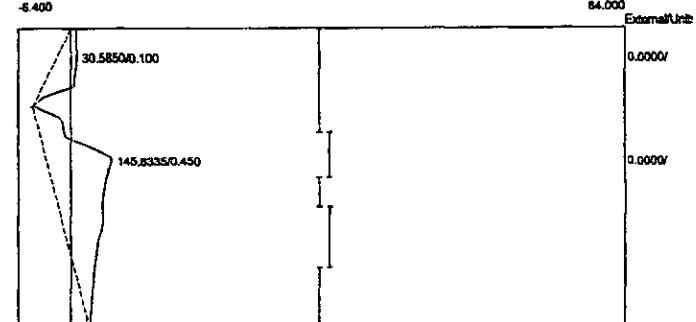
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	23.8590	0.0000	
Ambient H2O	0.433	157.5030	0.0000	
	11.5350	181.3620	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:39:40
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-3A02.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.8810	0.0000	
Ethylene Oxide	0.583	9.8100	22.7277	ppm
	11.6910	22.7277		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:39:40
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-3A02.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.100	30.5850	0.0000	
Ambient H2O	0.450	145.8335	0.0000	
	176.4185	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 15:44:14

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-3A03.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 15:44:14

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

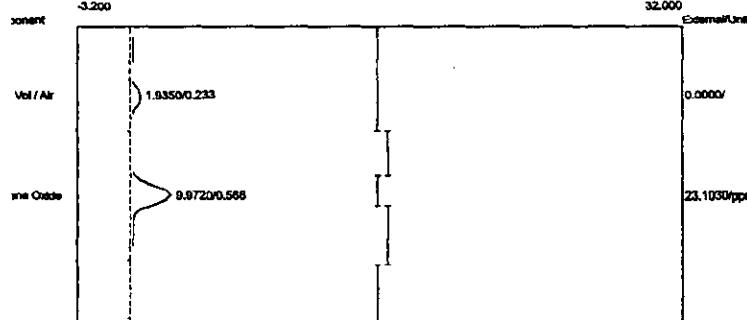
Temp. prog: eto-100.tem

Components: eto2-100.cpt

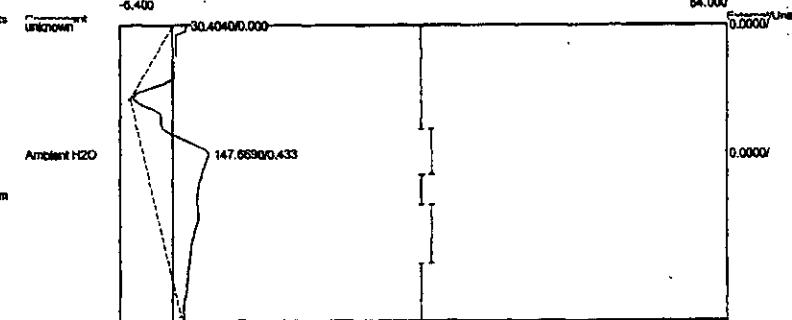
Data file: 2Ster2WB2016-3A03.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer

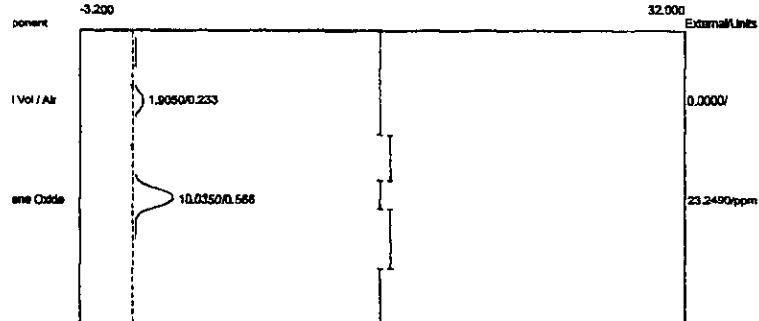


Component	Retention	Area	External	Units
ad Vol / Air	0.233	1.9350	0.0000	
Ethylene Oxide	0.566	9.9720	23.1030	ppm
	11.9070	23.1030		



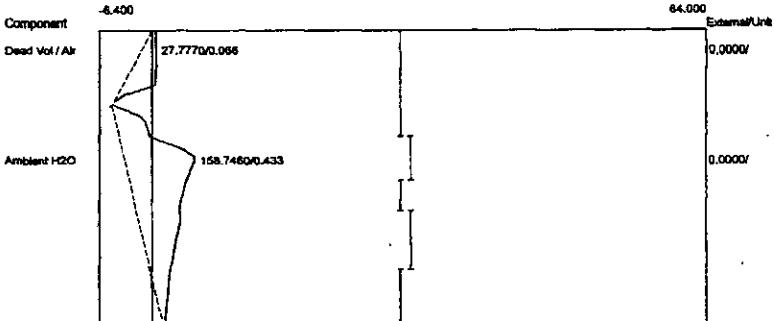
Component	Retention	Area	External	Units
Ambient H2O	0.433	147.6690	0.0000	
	147.6690	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:49:15
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-3A04.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



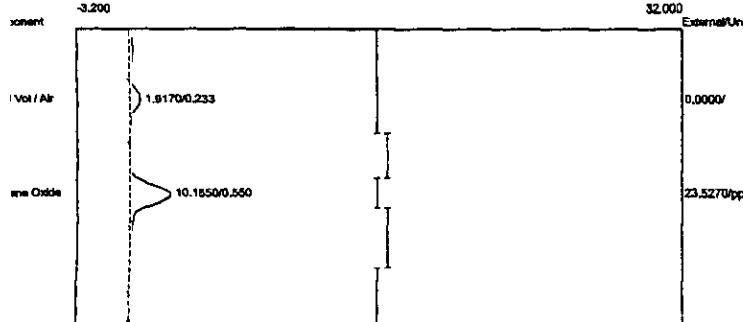
Component	Retention	Area	External	Units
Ethylene Oxide	0.233	1.9050	0.0000	
Ethylene Oxide	0.566	10.0350	23.2490	ppm
	11.9400	23.2490		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:49:15
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-3A04.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



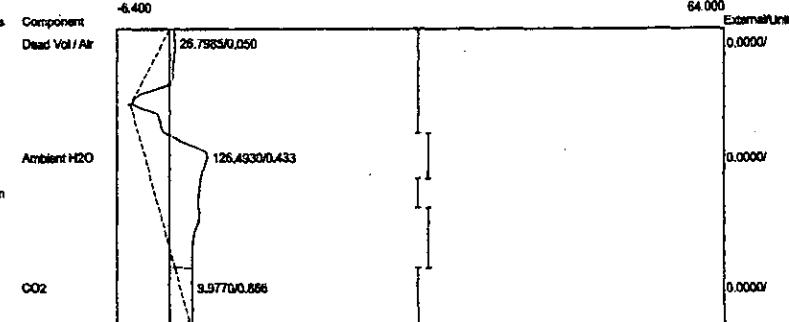
Component	Retention	Area	External	Units
Ambient H2O	0.066	27.7770	0.0000	
Ambient H2O	0.433	158.7460	0.0000	
	186.5230	0.0000		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:54:20
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-3A05.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



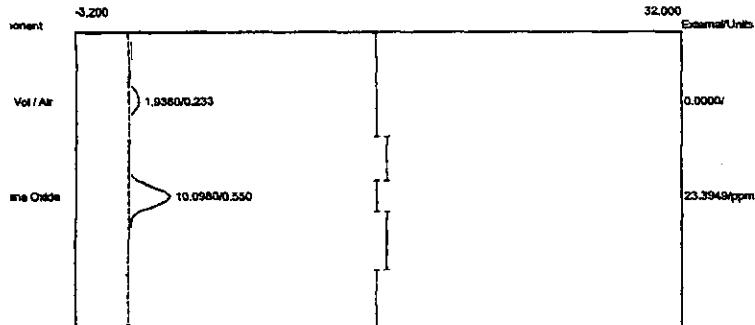
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9170	0.0000	
Ethylene Oxide	0.550	10.1550	23.5270 ppm	
	12.0720	23.5270		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:54:20
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, Carbopack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-3A05.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



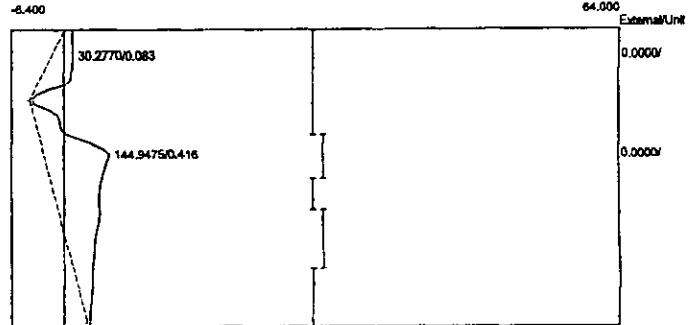
Component	Retention	Area	External	Units
Dead Vol / Air	0.050	26.7985	0.0000	
Ambient H2O	0.433	126.4930	0.0000	
CO2	0.866	9.9770	0.0000	
		163.2685	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:59:16
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-3A06.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



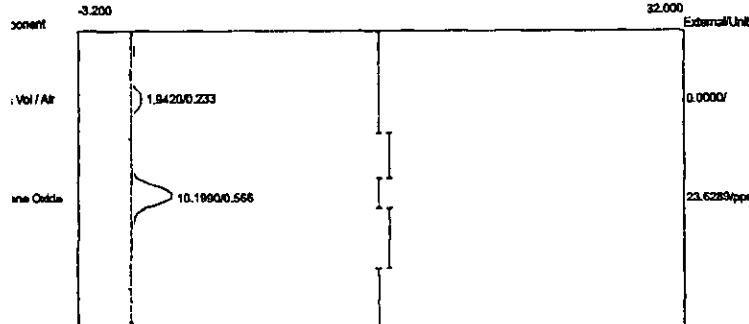
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9360	0.0000	
Ethylene Oxide	0.550	10.0980	23.3949 ppm	
	12.0340	23.3949		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 15:59:16
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-3A06.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer

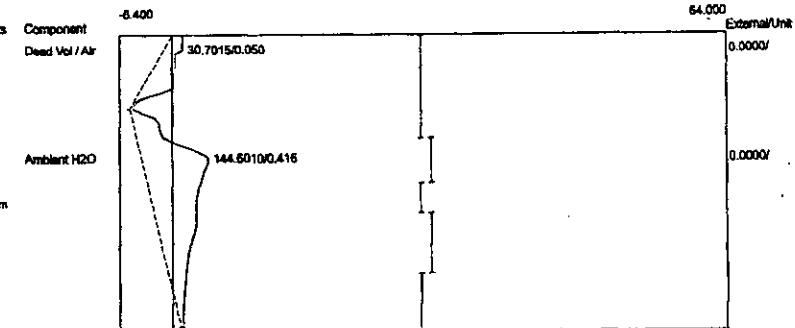


Component	Retention	Area	External	Units
Dead Vol / Air	0.083	30.2770	0.0000	
Ambient H2O	0.416	144.9475	0.0000	
		175.2245	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 16:04:06
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-3A07.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 16:04:06
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPack B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-3A07.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9420	0.0000	
Ethylene Oxide	0.566	10.1990	23.6289 ppm	
		12.1410	23.6289	

Component	Retention	Area	External	Units
Dead Vol / Air	0.050	30.7015	0.0000	
Ambient H2O	0.416	144.6010	0.0000	
		175.3025	0.0000	

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:09:04

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-3A08.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:09:04

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

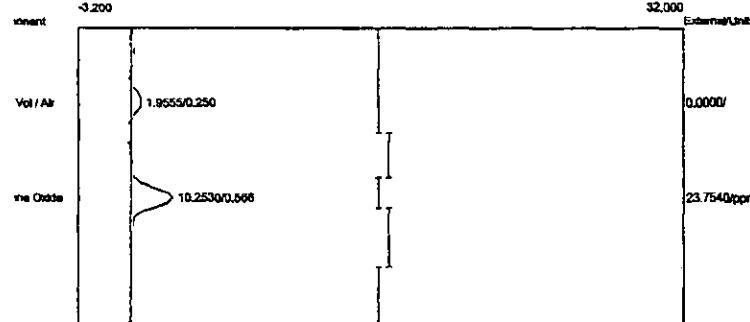
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3A08.CHR (c:\peak359)

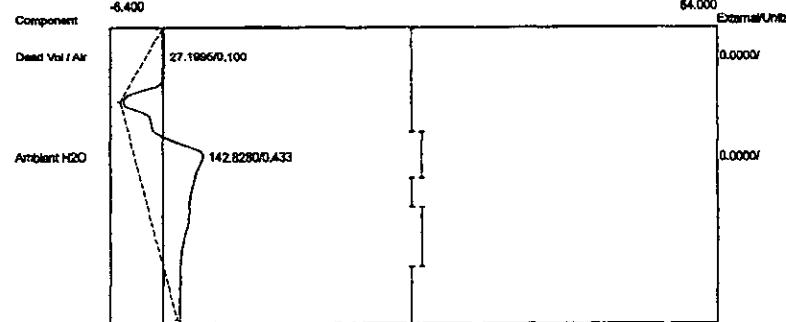
Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
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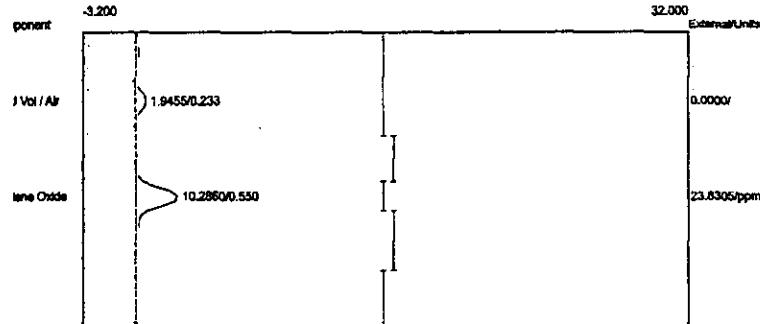
ad Vol / Air	0.250	1.9555	0.0000	
ethylene Oxide	0.566	10.2530	23.7540 ppm	
	12.2085	23.7540		



Component	Retention	Area	External	Units
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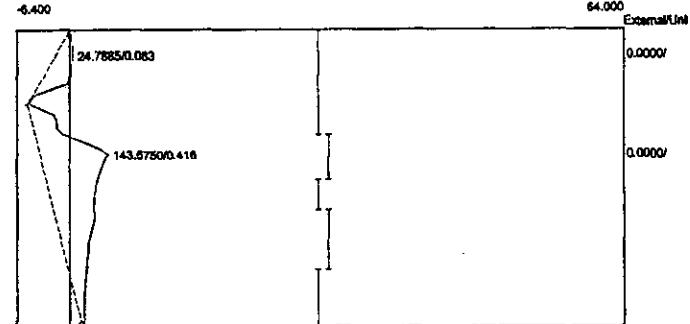
Dead Vol / Air	0.100	27.1995	0.0000	
Ambient H2O	0.433	142.8280	0.0000	
		170.0275	0.0000	

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 16:14:14
 Method: Direct Injection
 Description: CHANNEL 1 - FID
 Column: 1% SP-1000, CarboPak B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto1-100.cpt
 Data file: 1Ster2WB2016-3A09.CHR (c:\peak359)
 Sample: AAT Safe Cell Inlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9455	0.0000	
Ethylene Oxide	0.550	10.2860	23.8305	ppm
	12.2315	23.8305		

Client: Sterigenics - Willowbrook 2
 Client ID: Run#3Aer
 Analysis date: 12/13/2016 16:14:14
 Method: Direct Injection
 Description: CHANNEL 2 - PID
 Column: 1% SP-1000, CarboPak B
 Carrier: HELIUM
 Temp. prog: eto-100.tem
 Components: eto2-100.cpt
 Data file: 2Ster2WB2016-3A09.CHR (c:\peak359)
 Sample: AAT Safe Cell Outlet
 Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	24.7885	0.0000	
Ambient H2O	0.416	143.6750	0.0000	
	168.4635	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:19:30

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-3A10.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:19:30

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPack B

Carrier: HELIUM

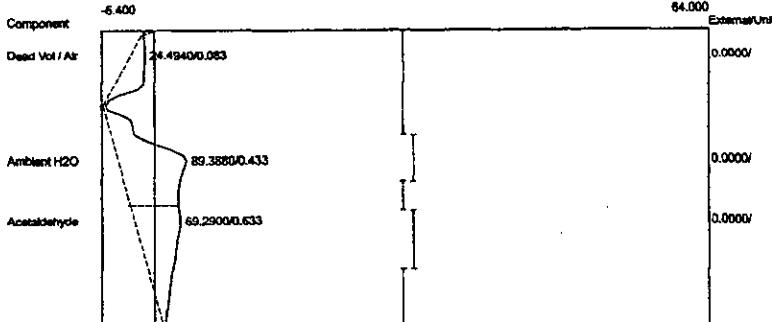
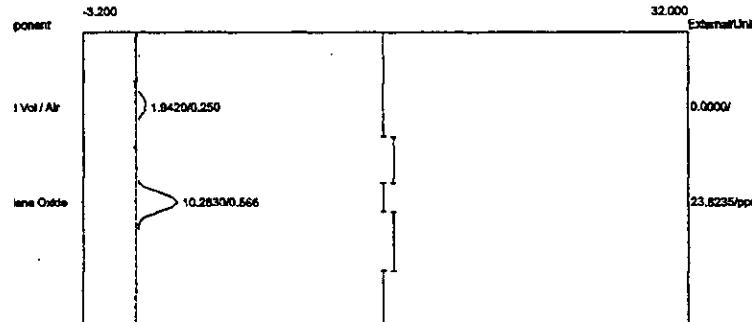
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3A10.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
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Dead Vol / Air	0.250	1.9420	0.0000	
Ethylene Oxide	0.566	10.2830	23.8235 ppm	
	12.2250	23.8235		

Component	Retention	Area	External	Units
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Dead Vol / Air	0.083	24.4940	0.0000	
Ambient H2O	0.433	89.3880	0.0000	
Acetaldehyde	0.633	69.2900	0.0000	
	183.1720	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:24:05

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-3A11.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:24:05

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

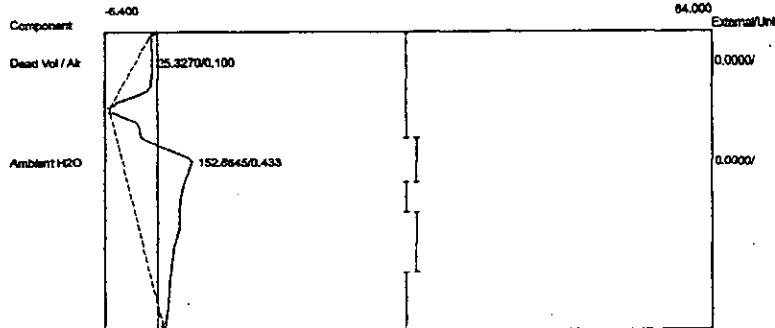
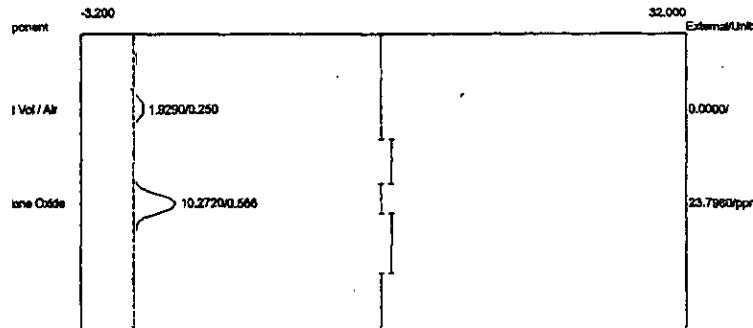
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3A11.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9290	0.0000	
Methylene Oxide	0.566	10.2720	23.7980	ppm
	12.2010	23.7980		

Component	Retention	Area	External	Units
Dead Vol / Air	0.100	25.3270	0.0000	
Ambient H2O	0.433	152.8645	0.0000	
	178.1915	0.0000		

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:29:17

Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1Ster2WB2016-3A12.CHR (c:\peak359)

Sample: AAT Safe Cell Inlet

Operator: D. Kremer

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Aer

Analysis date: 12/13/2016 16:29:17

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

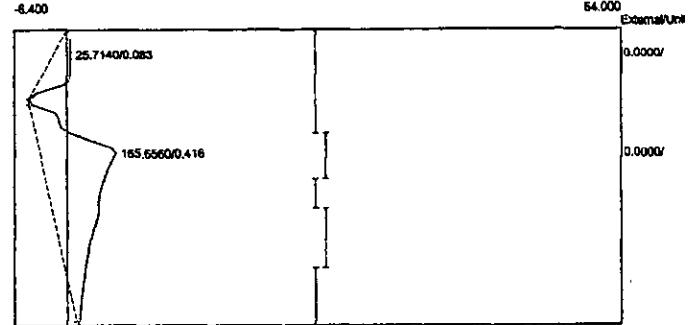
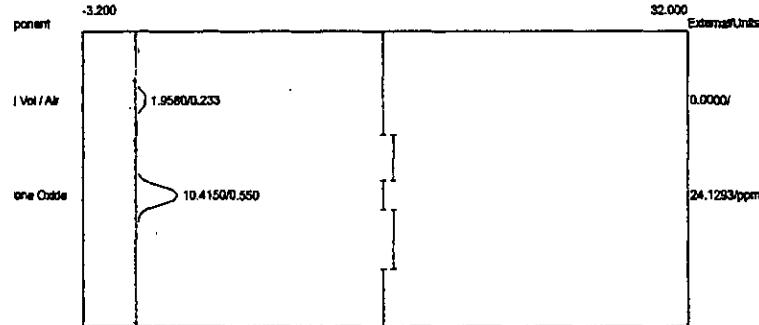
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3A12.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9580	0.0000	
Ethylene Oxide	0.550	10.4150	24.1293 ppm	
		12.3730	24.1293	

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	25.7140	0.0000	
Ambient H2O	0.416	165.6560	0.0000	
		191.3700	0.0000	

APPENDIX E
Run#1 Chromatograms - Exhaust

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

Analyst date: 12/13/2016 12:50:57

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

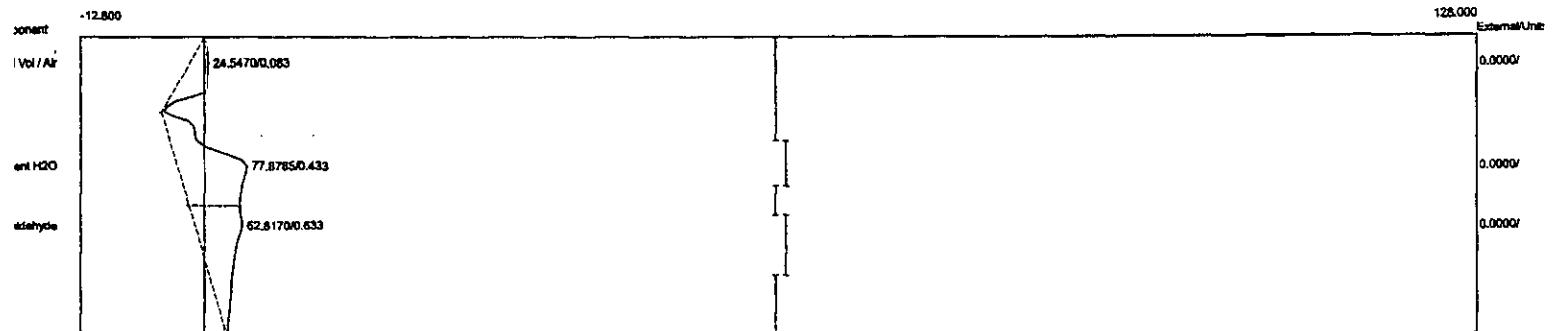
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1E01.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
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ad Vol / Air	0.083	24.5470	0.0000	
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ambient H2O	0.433	77.8785	0.0000	
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formaldehyde	0.633	62.8170	0.0000	
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	165.2425	0.0000		
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Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

Analysis date: 12/13/2016 12:52:07

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

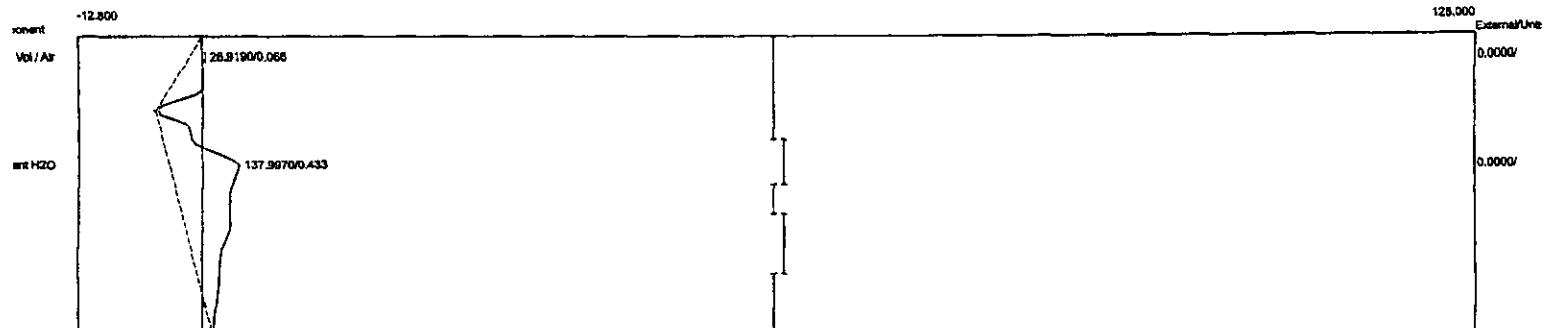
Temp. prog: etc-100.tem

Components: etc2-100.cpt

Data file: 2Ster2WB2016-1E02.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.066	26.9190	0.0000	
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Ambient H2O	0.433	137.9970	0.0000	
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	164.9160	0.0000	
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Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

Analysis date: 12/13/2016 12:53:14

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

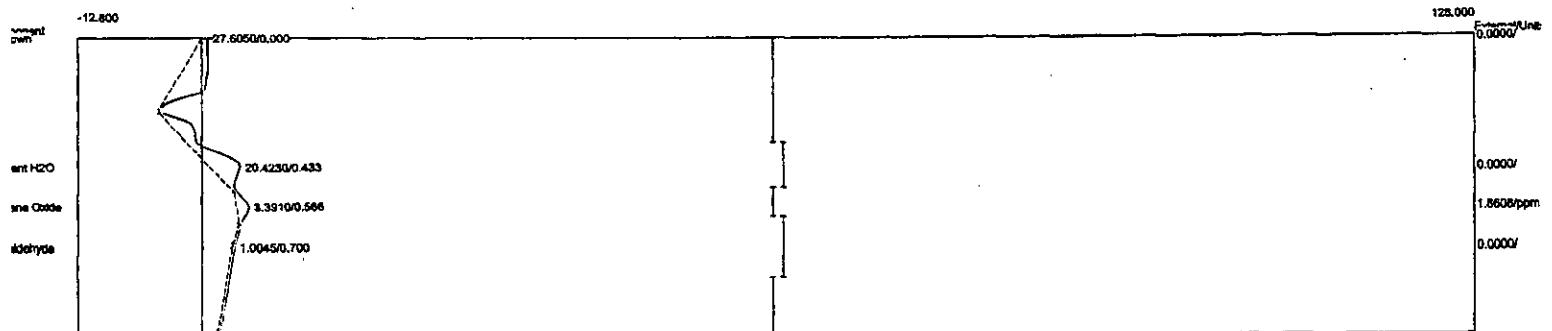
Temp. prog: eto-100.ter

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1E03.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
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ambient H2O	0.433	20.4230	0.0000	
Ethylene Oxide	0.566	3.3910	1.8608	ppm
Formaldehyde	0.700	1.0045	0.0000	
		24.8185	1.8608	

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

Analysis date: 12/13/2016 12:54:27

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

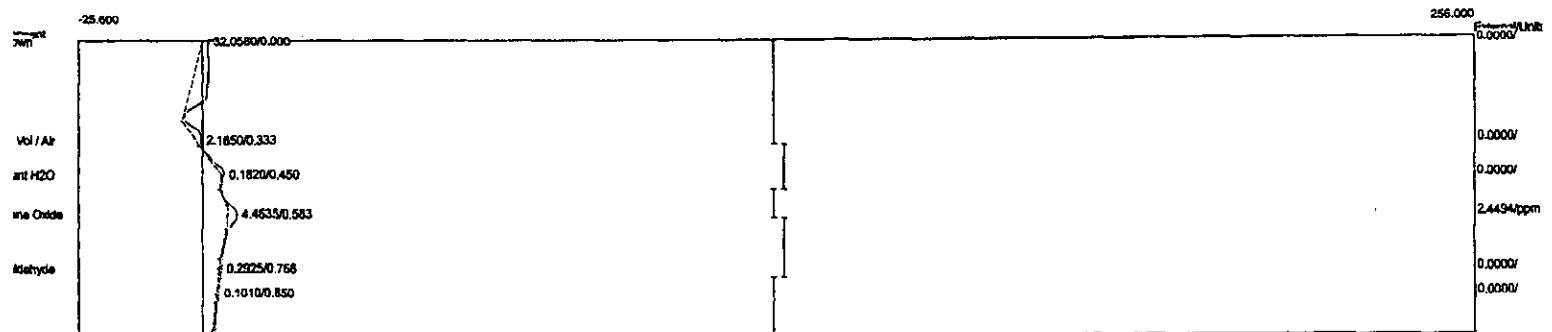
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1E04.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
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ad Vol / Air	0.333	2.1650	0.0000	
ambient H2O	0.450	0.1820	0.0000	
ethylene Oxide	0.583	4.4635	2.4494 ppm	
etaldehyde	0.766	0.2925	0.0000	
i2	0.850	0.1010	0.0000	
		7.2040	2.4494	

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

Analysis date: 12/13/2016 12:55:46

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

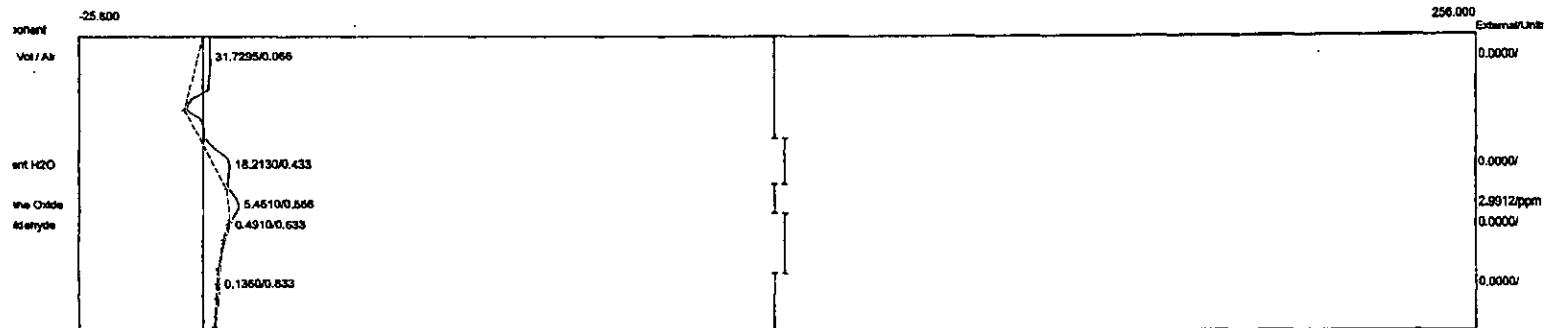
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1E05.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

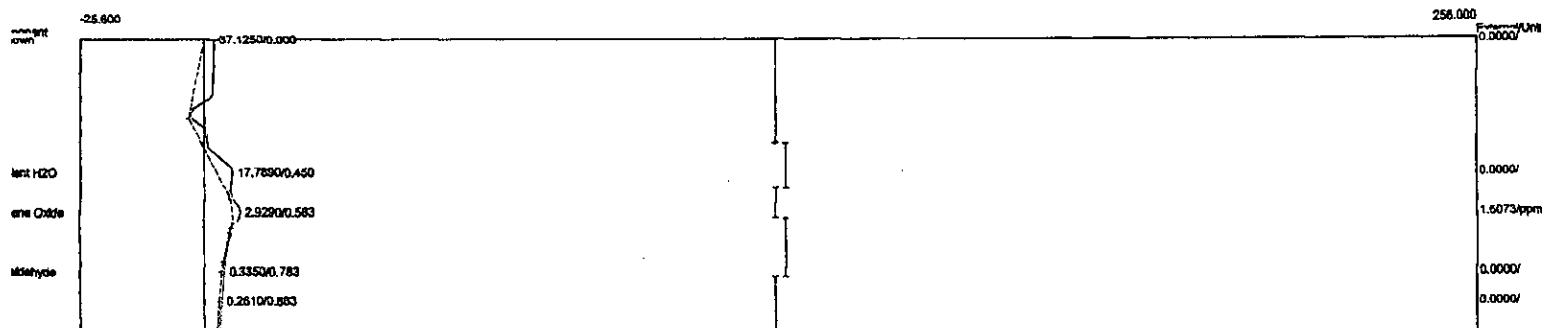
Operator: D. Kremer



Component	Retention	Area	External	Units
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Vol / Air	0.066	31.7295	0.0000	
ambient H2O	0.433	18.2130	0.0000	
Ethylene Oxide	0.566	5.4510	2.9912	ppm
Formaldehyde	0.633	0.4910	0.0000	
O2	0.833	0.1360	0.0000	
		56.0205	2.9912	

Client: Sterigenics - Willowbrook 2
Client ID: Run#1Exh
nalysis date: 12/13/2016 12:56:59
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, CarboPak B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2016-1E06.CHR (c:\peak359)
Sample: AAT Safe Cell Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Ambient H ₂ O	0.450	17.7890	0.0000	
Ethylene Oxide	0.583	2.9290	1.6073	ppm
Formaldehyde	0.783	0.3350	0.0000	
O ₂	0.883	0.2610	0.0000	
	21.3140	1.6073		

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

Analysis date: 12/13/2016 12:58:16

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

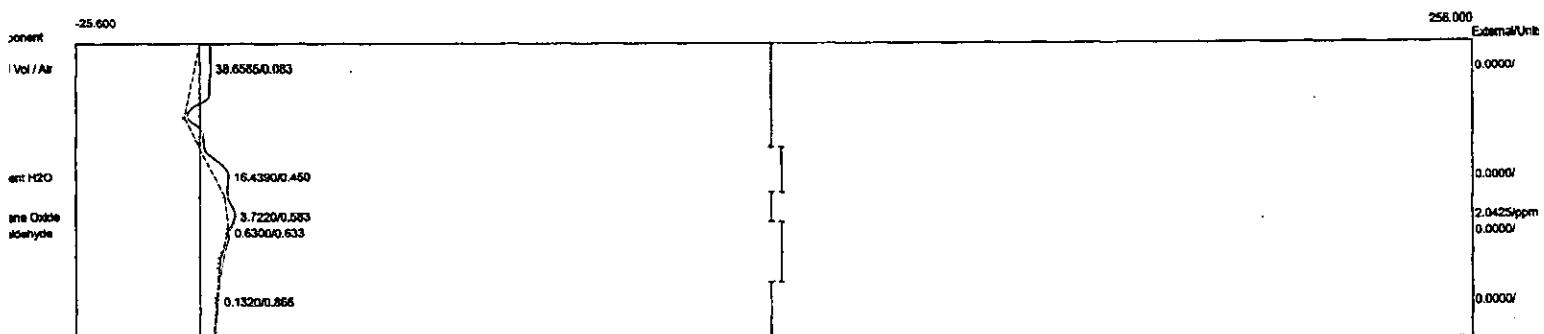
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1E07.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
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ad Vol / Air	0.083	38.6585	0.0000	
ambient H2O	0.450	16.4390	0.0000	
ethylene Oxide	0.583	3.7220	2.0425 ppm	
etaldehyde	0.633	0.6300	0.0000	
O2	0.866	0.1320	0.0000	

59.5815 2.0425

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

Analysis date: 12/13/2016 12:59:38

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

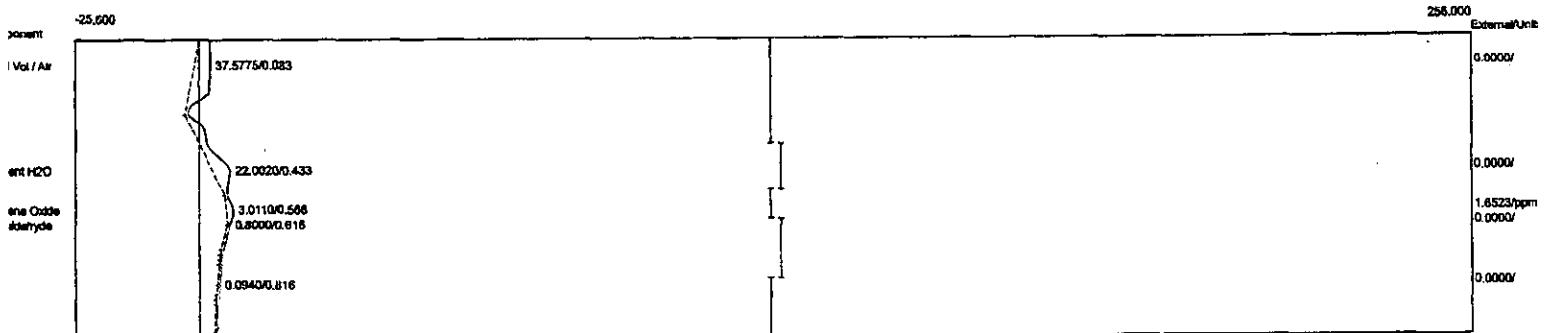
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1E08.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	37.5775	0.0000
mbient H2O	0.433	22.0020	0.0000
ylene Oxide	0.566	3.0110	1.6523 ppm
etaldehyde	0.616	0.8000	0.0000
O2	0.816	0.0940	0.0000

63.4845 1.6523

Client: Sterigenics - Willowbrook 2

Client ID: Run#1Exh

nalysis date: 12/13/2016 13:00:50

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPac B

Carrier: HELIUM

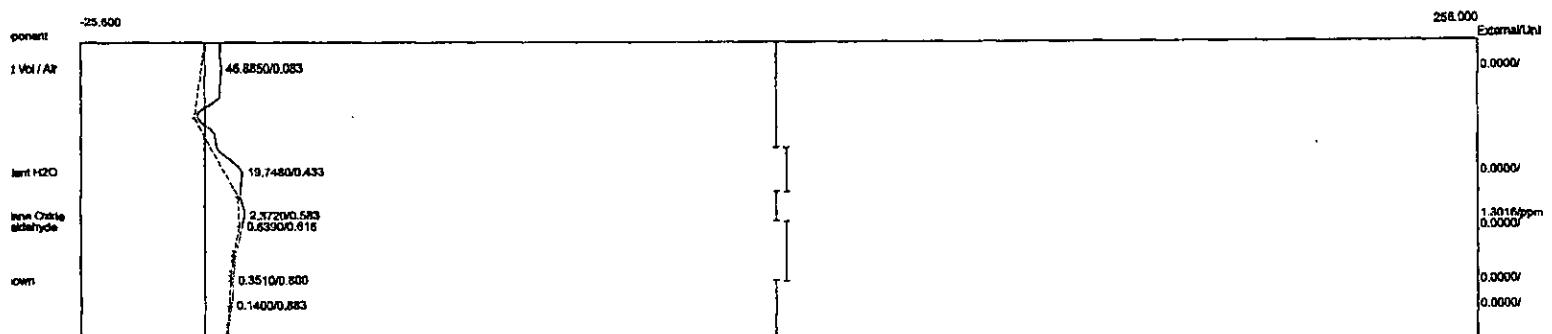
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-1E09.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



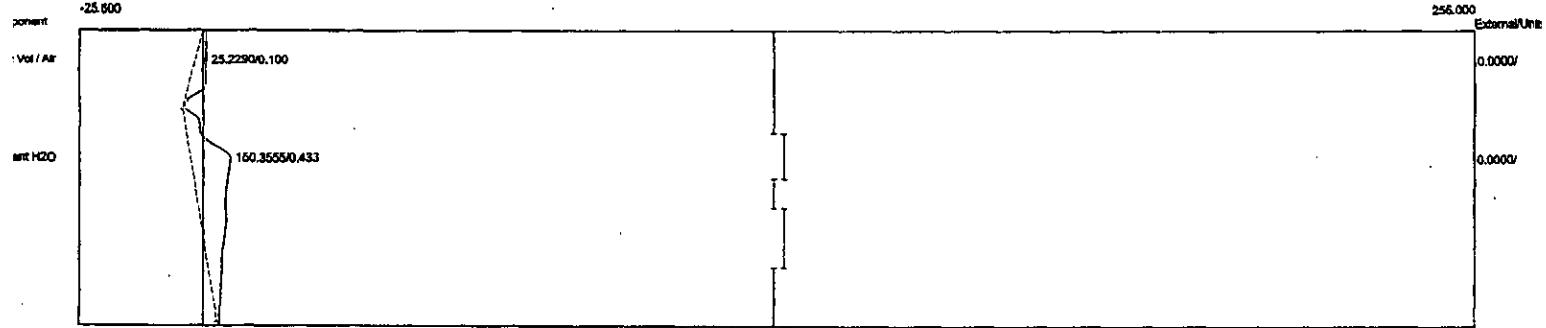
Component Retention Area External Units

Component	Retention	Area	External	Units
1 Vol / Air	0.083	46.8850	0.0000	
Ambient H2O	0.433	19.7480	0.0000	
ethylene Oxide	0.583	2.3720	1.3016	ppm
etaldehyde	0.616	0.6390	0.0000	
O2	0.883	0.1400	0.0000	

69.7840 1.3016

APPENDIX F
Run#2 Chromatograms - Exhaust

Client: Sterigenics - Willowbrook 2
Client ID: Run#2Exh
Analysis date: 12/13/2016 17:07:23
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, CarboPac B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2016-2E01.CHR (c:\peak359)
Sample: AAT Safe Cell Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
ad Vol / Air	0.100	25.2290	0.0000	
ambient H2O	0.433	150.3555	0.0000	
		175.5845	0.0000	

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:08:31

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

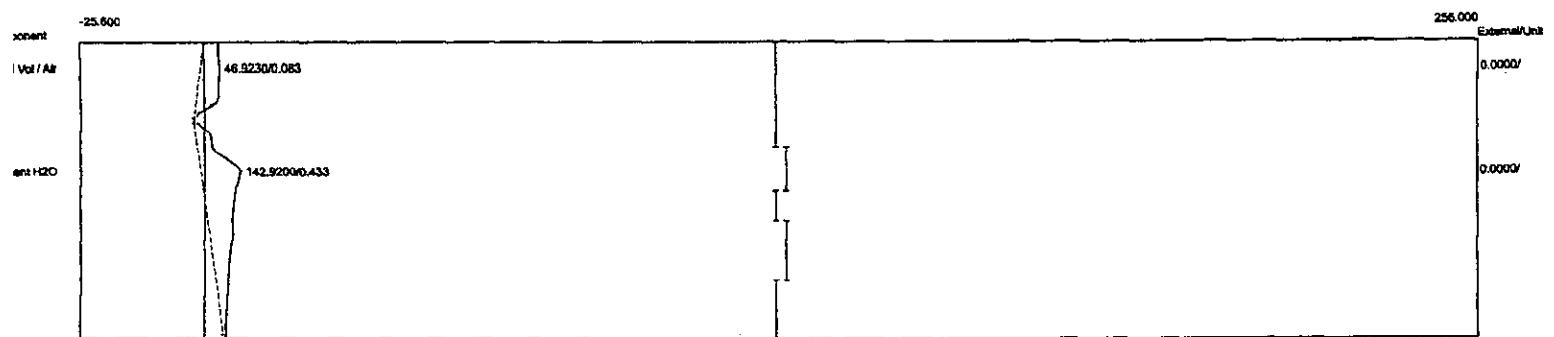
Temp. prog: elo-100:term

Components: elo2-100.cpt

Data file: 2Ster2WB2016-2E02.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	46.9230	0.0000	
--------------	-------	---------	--------	--

ambient H2O	0.433	142.9200	0.0000	
-------------	-------	----------	--------	--

	189.8430	0.0000		
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Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:09:39

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

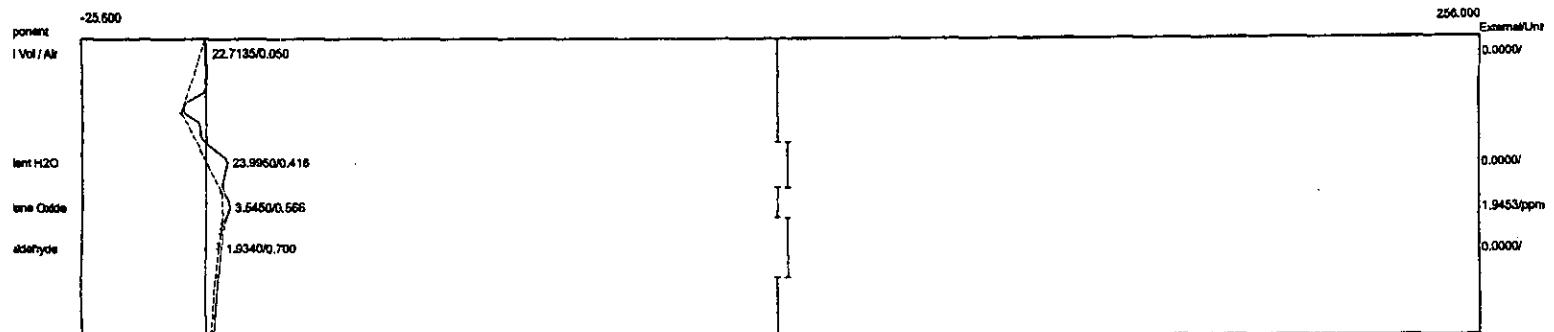
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2E03.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Ambient Vol / Air	0.050	22.7135	0.0000	
Ambient H2O	0.416	23.9950	0.0000	
Ethylene Oxide	0.566	3.5450	1.9453	ppm
Formaldehyde	0.700	1.9340	0.0000	

52.1875 1.9453

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:11:02

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

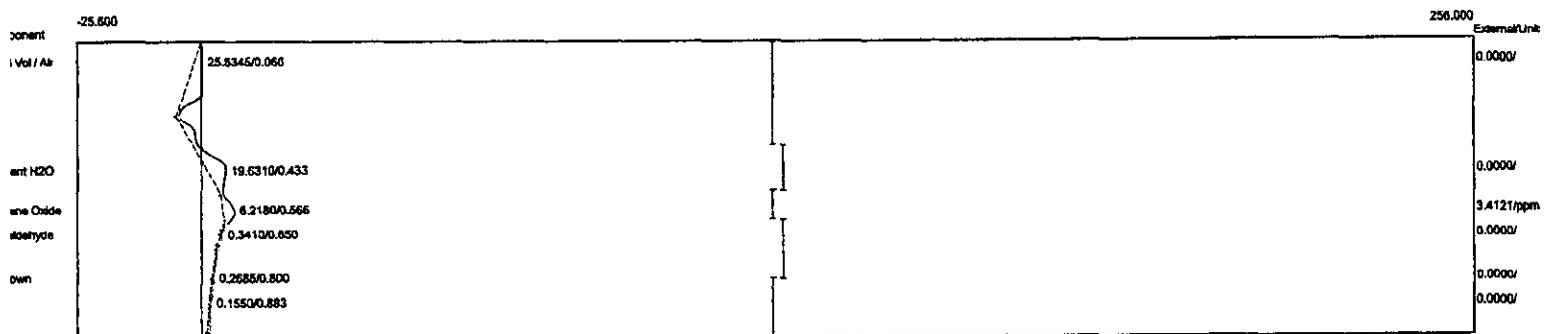
Temp. prog: eto-100.term

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2E04.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.066	25.5345	0.0000
ambient H2O	0.433	19.6310	0.0000
ethylene Oxide	0.566	6.2180	3.4121 ppm
etaldehyde	0.650	0.3410	0.0000
o2	0.883	0.1550	0.0000

51.8795 3.4121

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:12:13

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

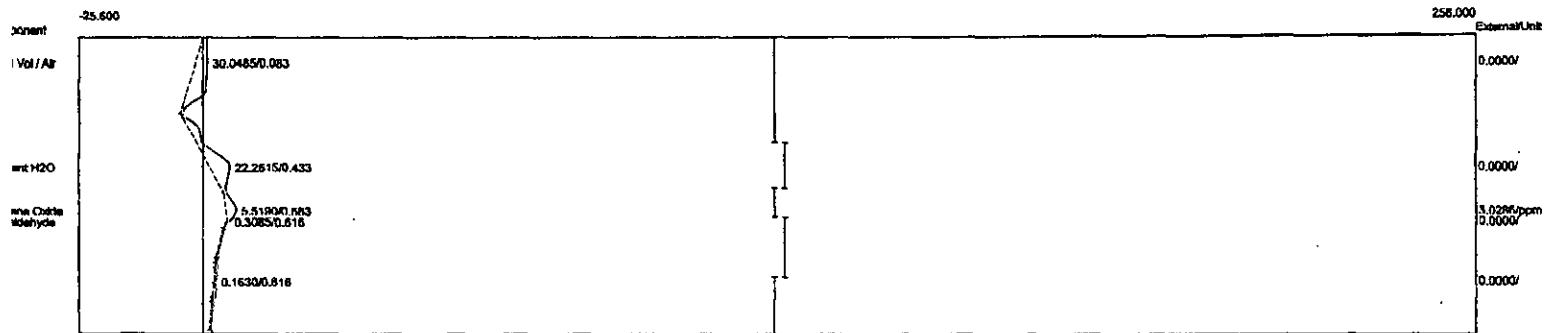
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2E05.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	30.0485	0.0000
ambient H2O	0.433	22.2615	0.0000
vinyl Oxide	0.583	5.5190	3.0286 ppm
formaldehyde	0.616	0.3085	0.0000
O2	0.816	0.1630	0.0000

	58.3005	3.0286	
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Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:13:23

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

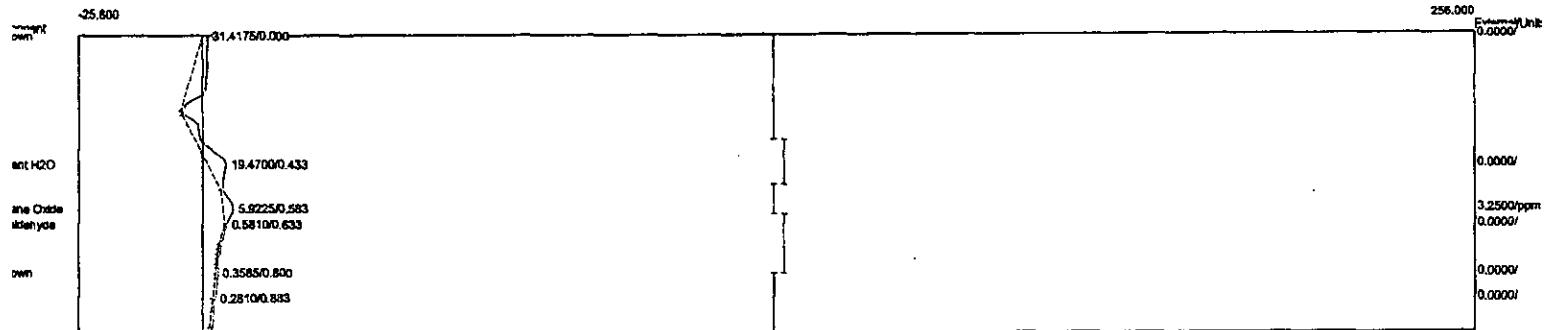
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2E06.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Ambient H ₂ O	0.433	19.4700	0.0000	
Ethylene Oxide	0.583	5.9225	3.2500	ppm
Acetaldehyde	0.633	0.5810	0.0000	
O ₂	0.883	0.2810	0.0000	
	26.2545	3.2500		

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:14:37

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

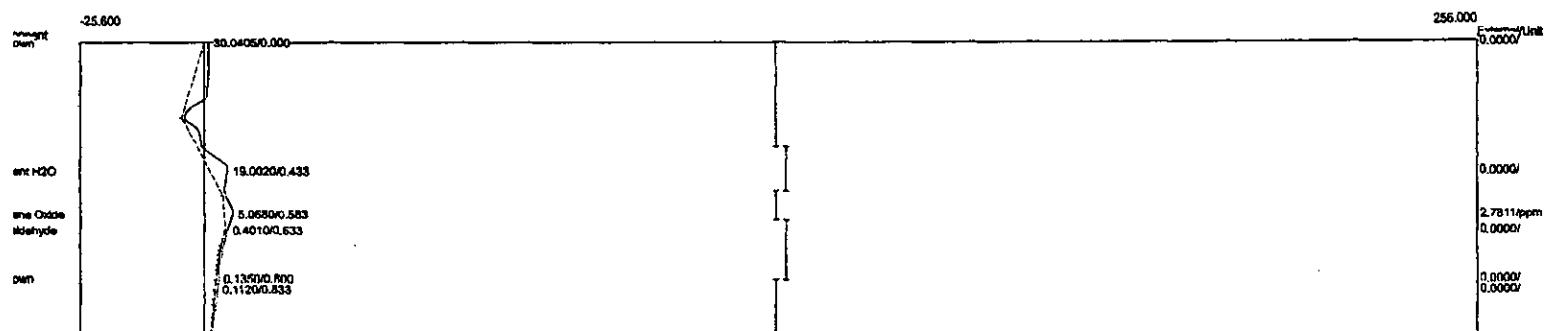
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2E07.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ambient H ₂ O	0.433	19.0020	0.0000
ethylene Oxide	0.583	5.0680	2.7811 ppm
etaldehyde	0.633	0.4010	0.0000
O ₂	0.833	0.1120	0.0000
	24.5830	2.7811	

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:15:52

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPac B

Carrier: HELIUM

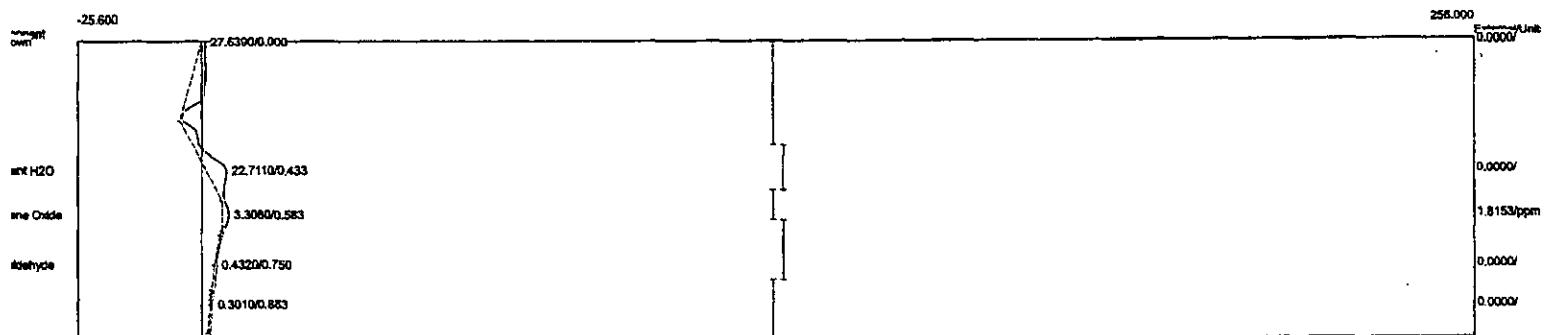
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2E08.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Ambient H ₂ O	0.433	22.7110	0.0000	
Ethylene Oxide	0.583	3.3080	1.8153	ppm
Formaldehyde	0.750	0.4320	0.0000	
O ₂	0.883	0.3010	0.0000	
		26.7520	1.8153	

Client: Sterigenics - Willowbrook 2

Client ID: Run#2Exh

Analysis date: 12/13/2016 17:17:05

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

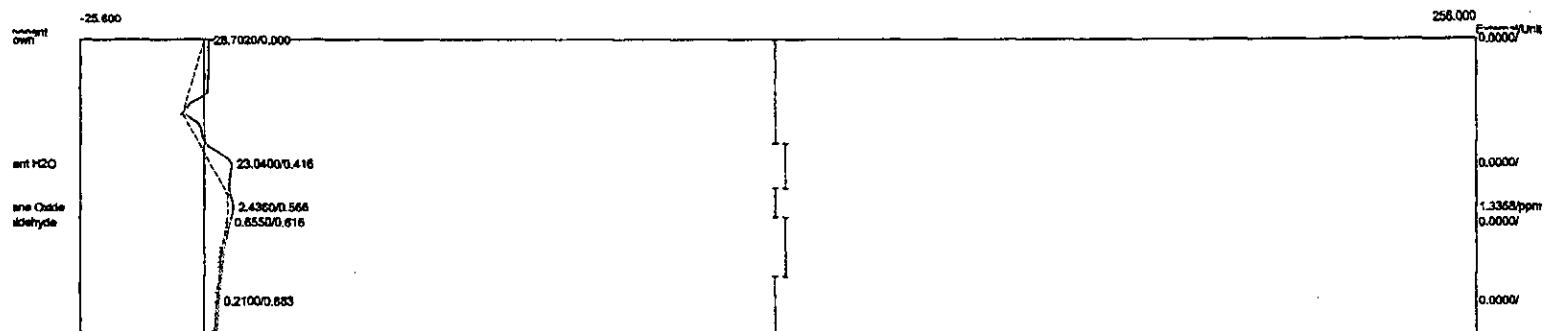
Temp. prog: eto-100:tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-2E09.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External Units
-----------	-----------	------	----------------

Ambient H ₂ O	0.416	23.0400	0.0000
Ethylene Oxide	0.566	2.4360	1.3368 ppm
Formaldehyde	0.616	0.6550	0.0000
H ₂	0.883	0.2100	0.0000

	26.3410	1.3368
--	---------	--------

APPENDIX G

Run#3 Chromatograms - Exhaust

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Exh

Analysis date: 12/13/2016 17:23:03

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPac B

Carrier: HELIUM

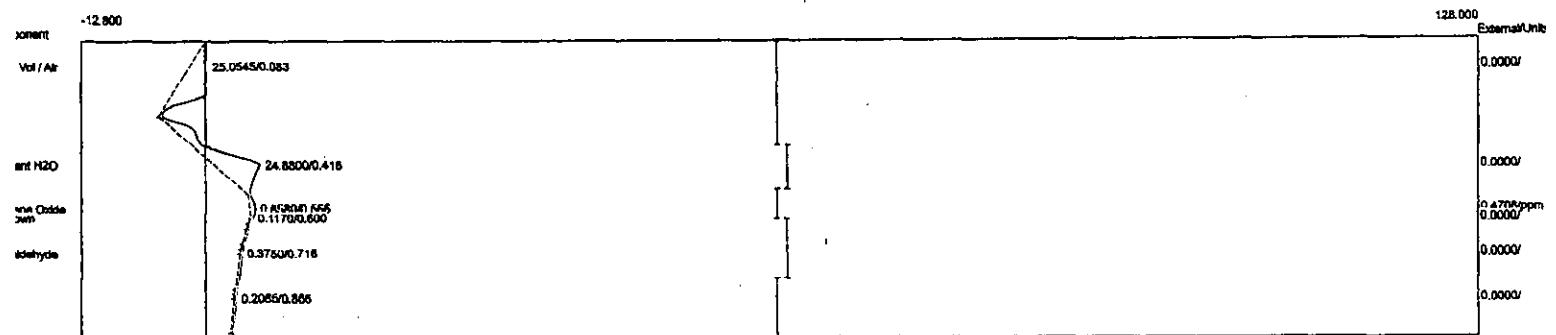
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3E01.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External Units
-----------	-----------	------	----------------

ad Vol / Air	0.083	25.0545	0.0000
ambient H2O	0.416	24.8800	0.0000
Ethylene Oxide	0.566	0.8580	0.4708 ppm
Formaldehyde	0.716	0.3750	0.0000
I2	0.866	0.2085	0.0000
		51.3760	0.4708

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Exh

Analysis date: 12/13/2016 17:24:17

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

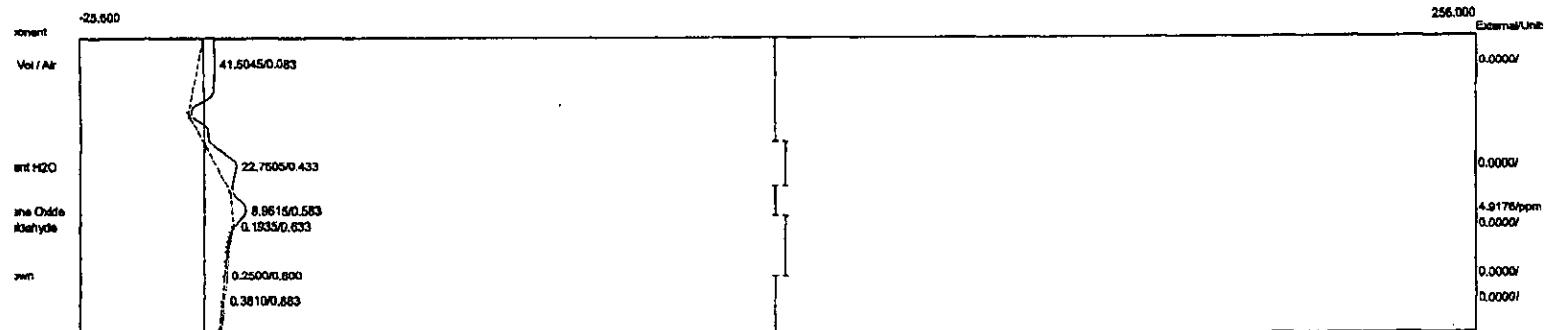
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3E02.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer.



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.083	41.5045	0.0000
ambient H2O	0.433	22.7605	0.0000
ethylene Oxide	0.583	8.9615	4.9176 ppm
etaldehyde	0.633	0.1935	0.0000
I2	0.883	0.3810	0.0000

73.8010 4.9176

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Exh

Analysis date: 12/13/2016 17:25:30

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carboback B

Carrier: HELIUM

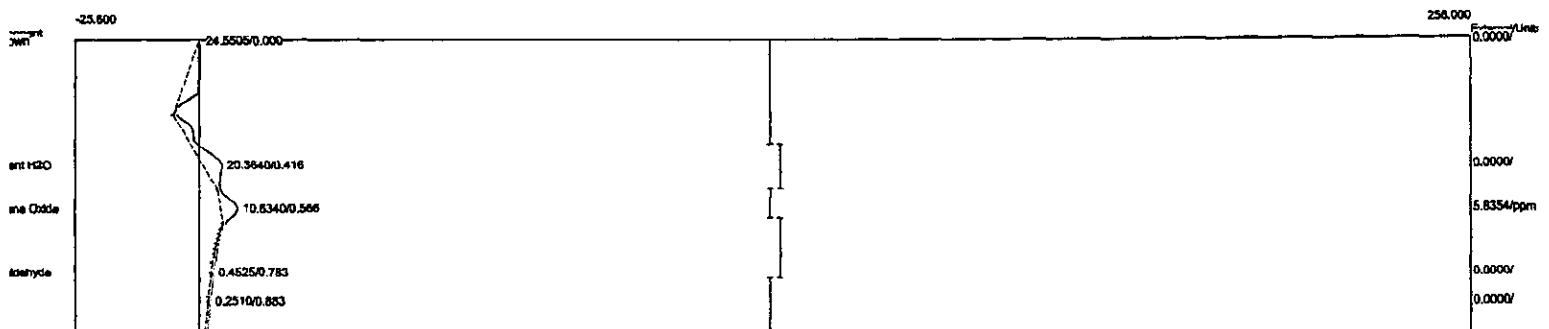
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3E03.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ambient H2O	0.416	20.3640	0.0000	
acetylene Oxide	0.566	10.6340	5.8354	ppm
formaldehyde	0.783	0.4525	0.0000	
I ₂	0.883	0.2510	0.0000	

31.7015 5.8354

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Exh

Analysis date: 12/13/2016 17:26:47

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

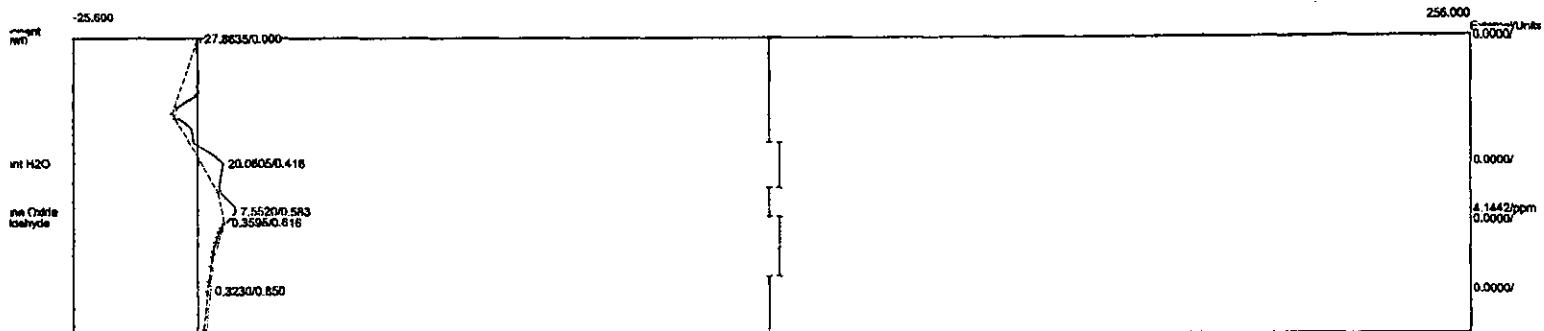
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3E04.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Ambient H2O	0.416	20.0605	0.0000	
Ethylene Oxide	0.583	7.5520	4.1442 ppm	
Acetaldehyde	0.616	0.3595	0.0000	
Water	0.850	0.3230	0.0000	
		28.2950	4.1442	

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Exh

Analysis date: 12/13/2016 17:28:00

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

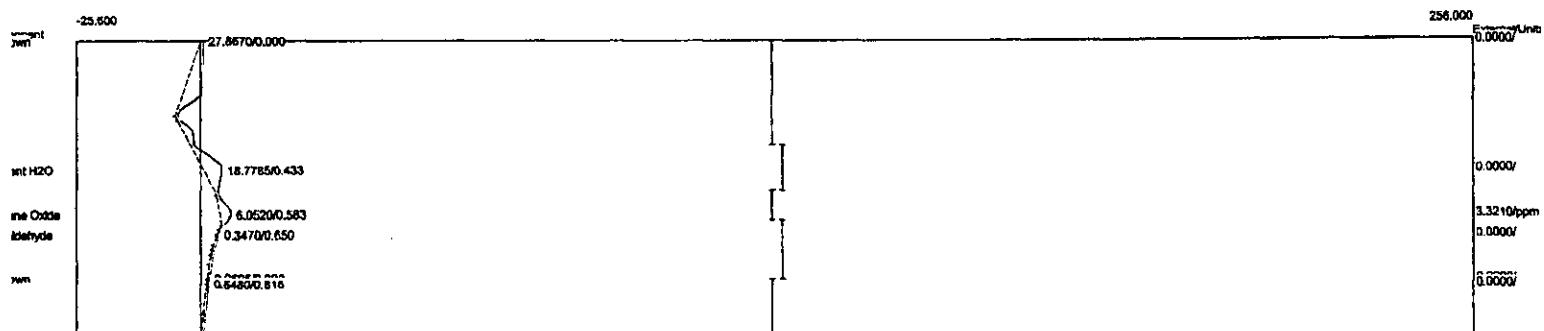
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3E05.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
Ambient H ₂ O	0.433	18.7785	0.0000	
Ethylene Oxide	0.583	6.0520	3.3210	ppm
Formaldehyde	0.650	0.3470	0.0000	
I ₂	0.816	0.6480	0.0000	
		25.8255	3.3210	

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Exh

Analysis date: 12/13/2016 17:29:10

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

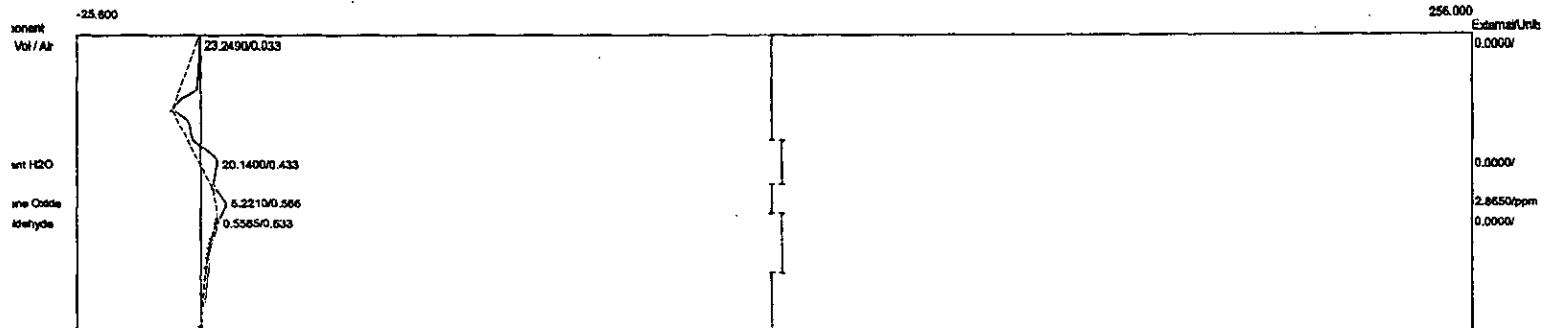
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3E06.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

Air/Vol / Air	0.033	23.2490	0.0000	
Ambient H2O	0.433	20.1400	0.0000	
Ethylene Oxide	0.566	5.2210	2.8650	ppm
Formaldehyde	0.633	0.5585	0.0000	
		49.1685	2.8650	

Client: Sterigenics - Willowbrook 2

Client ID: Run#3Exh

Analysis date: 12/13/2016 17:30:24

Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, CarboPak B

Carrier: HELIUM

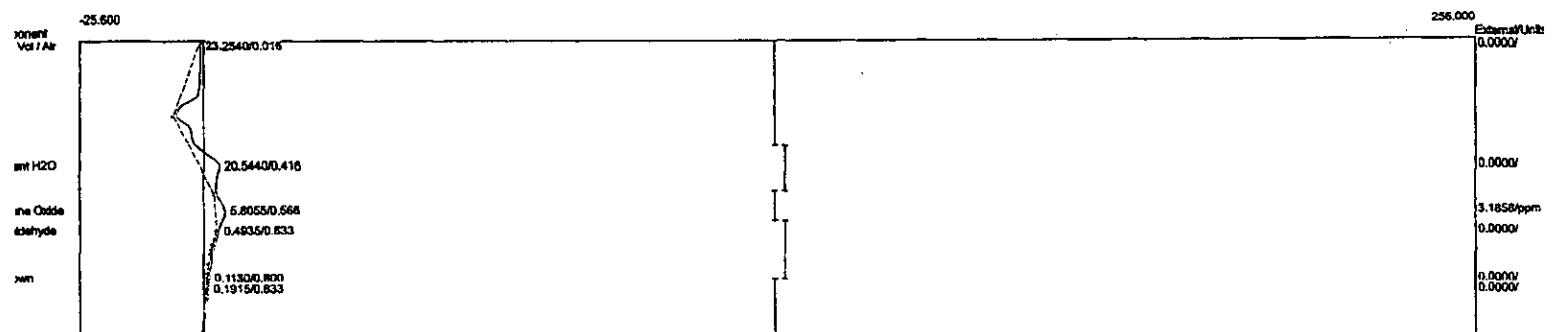
Temp. prog: eto-100.tem

Components: eto2-100.cpt

Data file: 2Ster2WB2016-3E07.CHR (c:\peak359)

Sample: AAT Safe Cell Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
-----------	-----------	------	----------	-------

ad Vol / Air	0.016	23.2540	0.0000
ambient H2O	0.416	20.5440	0.0000
Ethylene Oxide	0.566	5.8055	3.1858 ppm
Formaldehyde	0.633	0.4935	0.0000
I ₂	0.833	0.1915	0.0000
		50.2885	3.1858

APPENDIX H
Field Data and Calculation Worksheets

ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Sterigenics, Inc. - Willowbrook, IL (Plant 2)

12/13/16 - Aeration Runs 1-3

<u>DeltaP</u>	<u>SqRtDeltaP</u>	<u>Temp (F)</u>	<u>ppm EtO</u>	<u>mw =</u>	28.51	
		Run #1		<u>stack ID =</u>	36	in.
0.15	0.3873	74	0.01	<u>stack area =</u>	7.069	sq. ft.
0.15	0.3873	74	0.01	<u>press =</u>	29.20	
0.15	0.3873	74	0.01	<u>Tstd =</u>	528	
0.15	0.3873	75	0.01	<u>Pstd =</u>	29.92	
0.15	0.3873	75	0.01	<u>Cp =</u>	0.99	
0.15	0.3873	75	0.01	<u>Kp =</u>	85.49	
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01	<u>Velocity =</u>	26.3	ft/sec
0.15	0.3873	75	0.01	<u>Flow =</u>	10412	dscfm
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01	<u>MWeto =</u>	44.05	
0.15	0.3873	75	0.01	<u>MolVol =</u>	385.32	
		Run #2		<u>ppmv/ft3 =</u>	1000000	
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01	<u>EtO Mass Flow =</u>	0.000012	lbs/min
0.15	0.3873	75	0.01	<u>EtO Mass Flow =</u>	0.000714	lbs/hr
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	74	0.01			
0.15	0.3873	74	0.01			
0.15	0.3873	74	0.01			
0.15	0.3873	74	0.01			
0.15	0.3873	74	0.01			
		Run #3				
0.15	0.3873	76	0.01			
0.15	0.3873	76	0.01			
0.15	0.3873	76	0.01			
0.15	0.3873	76	0.01			
0.15	0.3873	76	0.01			
0.15	0.3873	76	0.01			
0.15	0.3873	76	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
0.15	0.3873	75	0.01			
Average =						
0.15	0.3873	75.0	0.0100			
		= 535 degR				

ECSI, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #1 - Exhaust Phase - Chamber K
AAT Safe Cell System - Dry Bed Outlet
Sterigenics EO, Inc. - Willowbrook, IL (Plant 2)
December 13, 2016

<u>DeltaP</u>	<u>SqRtDeltaP</u>	<u>Temp (F)</u>	<u>ppm EtO</u>	<u>stack ID =</u>	36	in.
				<u>stack area =</u>	7.069	sq. ft.
0.15	0.3873	74	0.01	<u>press =</u>	29.20	
0.15	0.3873	74	0.01	<u>Tstd =</u>	528	
0.15	0.3873	74	1.86	<u>Pstd =</u>	29.92	
0.15	0.3873	75	2.45	<u>Cp =</u>	0.99	
0.15	0.3873	75	2.99	<u>Kp =</u>	85.49	
0.15	0.3873	75	1.61			
0.15	0.3873	75	2.04	<u>Velocity =</u>	26.27	ft/sec
0.15	0.3873	75	1.65	<u>Flow =</u>	10415	dscfm
0.15	0.3873	75	1.30			
Average = 0.1500				<u>MWeto =</u>	44.05	
				<u>MolVol =</u>	385.32	
				<u>ppmv/ft3 =</u>	1000000	
				<u>EtO Mass Flow =</u>	0.0018416	lbs/min
				<u>evac start =</u>	1249	
				<u>evac stop =</u>	1301	
				<u>min/cycle =</u>	12	
				<u>Outlet EtO Emissions =</u>	0.02210	lbs/cycle

INLET CALCULATION:

Pre-Evac:	V =	1332	ft3	Post-Evac:	V =	1332	ft3
	P =	14.5	in Hg Abs		P =	3.0	in Hg Abs
	T =	125	degF		T =	125	degF
	R =	10.73			R =	10.73	
	mw =	44.05			mw =	44.05	
lbs EtO @ 100% =	66.44	lbs		lbs EtO @ 100% =	13.75	lbs	

Initial EtO = Scale Wt. =	60	lbs
% EtO @ Chamber = Scale Wt. / lbs EtO @ 100% (Pre) =	90.3	%
Final EtO = % EtO @ Chamber X lbs EtO @ 100% (Post) =	12.41	lbs
INLET ETO = Initial EtO - Final EtO =	47.6	lbs
Inlet EtO (from Aeration) =	2.215	lbs
TOTAL INLET ETO =	49.801	lbs
CONTROL EFFICIENCY =	99.9556	%

ECSI, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #2 - Exhaust Phase - Chamber K
AAT Safe Cell System - Dry Bed Outlet
Sterigenics, Inc. - Willowbrook, IL (Plant 2)
December 13, 2016

<u>DeltaP</u>	<u>SqRtDeltaP</u>	<u>Temp (F)</u>	<u>ppm EtO</u>	<u>stack ID =</u>	36	in.
				<u>stack area =</u>	7.069	sq. ft.
0.15	0.3873	75	0.01	<u>press =</u>	29.20	
0.15	0.3873	75	0.01	<u>Tstd =</u>	528	
0.15	0.3873	75	1.95	<u>Pstd =</u>	29.92	
0.15	0.3873	75	3.41	<u>Cp =</u>	0.99	
0.15	0.3873	75	3.03	<u>Kp =</u>	85.49	
0.15	0.3873	75	3.25			
0.15	0.3873	76	2.78	<u>Velocity =</u>	26.28	ft/sec
0.15	0.3873	75	1.82	<u>Flow =</u>	10411	dscfm
0.15	0.3873	75	1.34			
Average = 0.1500				<u>MWeto =</u>	44.05	
				<u>MolVol =</u>	385.32	
				<u>ppmv/ft3 =</u>	1000000	
				<u>EtO Mass Flow =</u>	0.0023275	lbs/min
				<u>evac start =</u>	1707	
				<u>evac stop =</u>	1718	
				<u>min/cycle =</u>	11	
				<u>Outlet EtO Emissions =</u>	0.02560	lbs/cycle

INLET CALCULATION:

Pre-Evac:	V = 1332	ft3	Post-Evac:	V = 1332	ft3
	P = 14.5	in Hg Abs		P = 3.0	in Hg Abs
	T = 126	degF		T = 124	degF
	R = 10.73			R = 10.73	
	mw = 44.05			mw = 44.05	
Ibs EtO @ 100% =	66.33	lbs	Ibs EtO @ 100% =	13.77	lbs

Initial EtO = Scale Wt. =	60	lbs
% EtO @ Chamber = Scale Wt. / Ibs EtO @ 100% (Pre) =	90.5	%
Final EtO = % EtO @ Chamber X Ibs EtO @ 100% (Post) =	12.46	lbs
INLET ETO = Initial EtO - Final EtO =	47.5	lbs
Inlet EtO (from Aeration) =	2.215	lbs
TOTAL INLET ETO =	49.759	lbs
CONTROL EFFICIENCY =	99.9485	%

ECSI, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #3 - Exhaust Phase - Chamber G
AAT Safe Cell System - Dry Bed Outlet
Sterigenics, Inc. - Willowbrook, IL (Plant 2)
December 13, 2016

<u>DeltaP</u>	<u>SqRtDeltaP</u>	<u>Temp (F)</u>	<u>ppm EtO</u>	<u>stack ID =</u>	36	in.
				<u>stack area =</u>	7.069	sq. ft.
0.15	0.3873	75	0.47	<u>press =</u>	29.20	
0.15	0.3873	75	4.92	<u>Tstd =</u>	528	
0.15	0.3873	75	5.84	<u>Pstd =</u>	29.92	
0.15	0.3873	75	4.14	<u>Cp =</u>	0.99	
0.15	0.3873	75	3.32	<u>Kp =</u>	85.49	
0.15	0.3873	75	2.87	<u>Velocity =</u>	26.28	ft/sec
0.15	0.3873	76	3.19	<u>Flow =</u>	10411	dscfm
Average =				<u>MWeto =</u>	44.05	
0.1500	0.3873	75	3.536	<u>MolVol =</u>	385.32	
= 535 degR				<u>ppmv/ft3 =</u>	1000000	
						<u>EtO Mass Flow =</u> 0.0042081 lbs/min
						<u>evac start =</u> 1722
						<u>evac stop =</u> 1731
						<u>min/cycle =</u> 9
						<u>Outlet EtO Emissions =</u> 0.03787 lbs/cycle

INLET CALCULATION:

Pre-Evac:	V =	1332	ft3	Post-Evac:	V =	1332	ft3
	P =	14.4	in Hg Abs		P =	3.0	in Hg Abs
	T =	125	degF		T =	125	degF
	R =	10.73			R =	10.73	
	mw =	44.05			mw =	44.05	
Ibs EtO @ 100% =	65.98	lbs		Ibs EtO @ 100% =	13.75	lbs	

Initial EtO = Scale Wt. =	59	lbs
% EtO @ Chamber = Scale Wt. / Ibs EtO @ 100% (Pre) =	89.4	%
Final EtO = % EtO @ Chamber X Ibs EtO @ 100% (Post) =	12.29	lbs
INLET ETO = Initial EtO - Final EtO =	46.7	lbs
Inlet EtO (from Aeration) =	2.215	lbs
TOTAL INLET ETO =	48.923	lbs

CONTROL EFFICIENCY = **99.9226** %

APPENDIX I
Gas Certifications

CERTIFIED WORKING CLASS*Single-Certified Calibration Standard***Scott Specialty Gases**

600 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard**Product Information**

Project No.: 02-57164-001
Item No.: 02020001310TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CAL4448
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

<u>Component Name</u>	<u>Concentration (Moles)</u>	<u>Accuracy (+/-%)</u>
ETHYLENE OXIDE NITROGEN	1.10 PPM BALANCE	5

TRACEABILITY**Traceable To**

Scott Reference Standard

APPROVED BY:

A handwritten signature consisting of the letters 'MT' written in cursive script.

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	1.	PPM BAL	1.10 PPM BAL	10.0
NITROGEN				5.00

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL Pressure: 1300 PSIG
Expiration Date: 18Apr2018

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



Scott Specialty Gases

100 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-003
Item No.: 02020001320TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CLM003232
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

<u>Component Name</u>	<u>Concentration (Moles)</u>	<u>Accuracy (+/-%)</u>
ETHYLENE OXIDE NITROGEN	10.1 PPM BALANCE	5

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:

MT

MT

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10.	PPM BAL	10.1 PPM BAL	1.0
NITROGEN				5.00

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL Pressure: 1400 PSIG
 Expiration Date: 18Apr2018

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



Scott Specialty Gases

50 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-004
Item No.: 02020001330TCL
P.O. No.: VBL - D. KREMER
Cylinder Number: CLM011385
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE
NITROGEN

Concentration (Moles)

100. PPM
BALANCE

Accuracy (+/-%)

5

TRACEABILITY

Traceable To:

Scott Reference Standard

APPROVED BY:

B. McElroy
BLM

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	100.	PPM	100.	PPM
NITROGEN		BAL		BAL

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1400 PSIG
Expiration Date: 18Apr2018

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFIED WORKING CLASS*Single-Certified Calibration Standard***Scott Specialty Gases**

500 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard**Product Information**

Project No.: 02-57164-005
Item No.: 02020001340TCL
P.O. No.: VBL - D. KREMER

Cylinder Number: CLM002810
Cylinder Size: CL
Certification Date: 18Apr2016

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

<u>Component Name</u>	<u>Concentration (Moles)</u>	<u>Accuracy (+/-%)</u>
ETHYLENE OXIDE NITROGEN	1,000. PPM BALANCE	5

TRACEABILITYTraceable To:

Scott Reference Standard

APPROVED BY:

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)	Certified Concentration (Moles)	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE NITROGEN	1,000.	PPM BAL	1,000. PPM BAL	.0 5.00

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL Pressure: 1300 PSIG Valve Connection: CGA 350
 Expiration Date: 18Apr2018

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



Scott Specialty Gases

500 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-006

Item No.: 02020001340TCL

P.O. No.: VBL - D. KREMER

Cylinder Number: CLM005787

Cylinder Size: CL

Certification Date: 18Apr2016

Customer

ECSI, INC

PO BOX 848

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE
NITROGEN

Concentration (Moles)

10,080. PPM
BALANCE

Accuracy (+/-%)

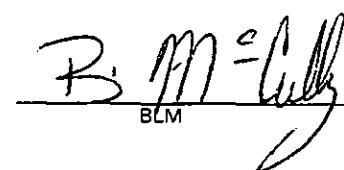
5

TRACEABILITY

Traceable To:

Scott Reference Standard

APPROVED BY:


B. M. Kelly

DATE: 4-18-16

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10,000.	PPM BAL	10,080.	PPM BAL	.8	5.00
NITROGEN						

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 800 PSIG
Expiration Date: 18Apr2018

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS



CERTIFICATE OF ANALYSIS

Customer Name:	ECSi, Inc.	Cylinder Number:	SA25925
Stock or Analyzer Tag Number:	N/A	Product Class:	Certified Standard
Customer Reference:	Verbal- Dan	Cylinder - Contents ¹ :	28 CF @ 2000 PSI
MESA Reference:	104448	Cylinder-CGA:	A006-HP-BR/350
Date of Certification:	4/20/2016	Analysis Method:	GC-TCD/FID
Recommended Shelf Life:	2 Years	Preparation Method:	Gravimetric

Component	Requested Concentration ²	Reported Concentration ^{2,3}
Ethylene Oxide	50 ppm	48.8 ppm
Nitrogen	Balance	Balance

Authorized Signature:

1. The fill pressure shown on the COA is as originally quoted. The fill pressure measured by the customer may differ from the fill pressure originally quoted due to temperature effects, compressibility of the individual components when blended together in the cylinder, gauge accuracy or reduction in content volume before shipping as a result of samples withdrawn for laboratory QC necessary to ensure product quality.
2. Unless otherwise stated, concentrations are given in molar units.
3. Vapor pressure mixes are blended at a sufficiently low pressure so as to eliminate phase separation under most low temperature conditions encountered during transport or storage. However, it is generally recommended that cylinders containing vapor pressure restricted mixes be placed on the floor in a horizontal position and rolled back and forth to improve homogeneity of the gas phase mixture before being put into service.

Analytical Gas Standards are prepared and analyzed using combinations of NIST traceable weights, SRM's provided by NIST, or internal gas standards that have been verified for accuracy using procedures published by the US-EPA. Pure gases are analyzed and certified for purity using minor component Analytical Gas Standards prepared according to the methods specified above. Balances are calibrated to NIST test weights covered by NIST test number 822/256175/96. Reference Certification #'s: 163/W, 830/N and 3280. Calibration methods are in conformance with MIL-STD 45662A.

MESA Specialty Gases & Equipment

division of MESA International Technologies, Inc.

3619 Pendleton Avenue, Suite C • Santa Ana, California 92704 • USA
TEL.: 714-434-7102 • FAX: 714-434-8006 • E-mail: mail@mesagas.com
On-line Catalog at www.mesagas.com

APPENDIX J

Process Data

Process Run Record

Sterigenics International, Inc.
7775 S. Quincy Street
Willowbrook, IL 60527
Tel: +1 (630) 654-5151

Run ID:	304145	Pallet Count:	0	Equipment:	Chamber G
Customer:	Sterigenics International			Workorder Num:	1860461
Specification:	17.1	Checksum:	-24959	Cycle:	Antares Cycle 751/CV 22130
Description:	ENG #9-12DEC2016				
Date Started:	13-Dec-16 21:38:07			Date Completed:	
Date Aborted:	13-Dec-16 23:22:04	Aborted!		Aborted By:	Ray Cruz
Additional Info:	TEST				

1. Phase » General Configuration

(Phase No.0)

Date /
Time

13-Dec-16

21:38:07

INFO: Run ID 304145 has started

2. Phase » Start-up Phase

(Phase No.1)

Date / Time	[°F]	[inHg]
Avg.	Chamber	Current Pressure
Gas Temp		

13-Dec-16

21:38:08 122.5 29.4

21:39:28 123.0 29.3

21:39:33 123.1 29.3

3. Phase » Vacuum

(Phase No.2)

Date / Time	[°F]	[inHg]
Avg.	Chamber	Current Pressure
Gas Temp		

13-Dec-16

21:39:33 123.1 29.3

21:40:34 123.4 26.6

21:41:34 123.8 24.6

21:42:34 124.1 22.6

21:43:34 124.3 20.4

21:44:34 124.5 18.2

21:45:34 124.7 16.3

21:46:34 124.9 14.5

21:47:34 125.1 12.7

21:48:34 125.3 11.0

21:49:34 125.4 9.3

21:50:34 125.5 7.5

21:51:34 125.6 6.0

9. Phase » EO Inject by Pressure

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure	[mg/l] AT-EO	[lbs] EO Weight Used
13-Dec-16				
23:05:25	125.0	7.3	277.6	25
23:06:25	125.1	8.4	342.1	30
23:07:25	125.1	9.4	409.3	35
23:08:25	125.2	10.4	471.2	40
23:09:25	125.3	11.4	533.3	45
23:10:25	125.3	12.4	596.5	49
23:11:25	125.4	13.4	660.1	54
23:12:25	125.5	14.4	724.0	59
23:12:25	125.5	14.4	724.7	59
23:12:30	125.5	14.5	732.8	59

Step Gas Usage

ID	Gas	Drum S/N	Lot Number	Usage Value
513	EO	E000230	UTLX902730L16	59lbs

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	00:12:06	00:06:27 - 00:25:48
Elapsed Phase Time	Final	00:12:06	n/a - N/A
TempAve	Min	124.7 °F	120.0 - 130.0 °F
TempAve	Max	125.5 °F	120.0 - 130.0 °F
PCurr	Final	14.5 inHg	13.9 - 15.9 inHg
PCurr	Final	14.5 inHg	n/a - 14.9 inHg
AT-EO	Final	732.8 mg/l	N/A - N/A mg/l
EO Weight Used	Final	59 lbs	N/A - N/A lbs

10. Phase » EO Dwell

(Phase No. 7)

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure	[mg/l] AT-EO	[lbs] EO Weight Used	[mg/l] AT-AH	[%] RH Sensor
13-Dec-16						

23:12:30	125.5	14.5	733.2	0	15.1	N/A
23:13:31	125.5	14.4	768.6	0	15.6	N/A
23:14:31	125.5	14.4	770.8	0	15.1	N/A
23:15:31	125.5	14.4	772.9	0	16.0	N/A
23:16:31	125.5	14.4	773.2	0	15.6	N/A
23:17:31	125.5	14.4	773.1	0	16.0	N/A
23:18:31	125.5	14.4	773.2	0	16.5	N/A
23:19:31	125.5	14.4	773.1	0	16.5	N/A
23:20:31	125.4	14.4	773.1	0	16.3	N/A
23:21:31	125.3	14.4	773.1	0	16.9	N/A
23:22:04	125.3	14.4	775.4	0	16.5	N/A

OPR Operator has requested abort
 DVN Current Phase Time has a measurement value of 00:09:34. The min specified value is 00:59:00

10. Phase » EO Dwell

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	00:09:34	00:59:00 - 05:00:00
Elapsed Phase Time	Final	00:09:34	n/a - N/A
TempAve	Min	125.3 °F	120.0 - 130.0 °F
TempAve	Max	125.5 °F	120.0 - 130.0 °F
PCurr	Min	14.4 inHg	14.0 - 16.0 inHg
PCurr	Min	14.4 inHg	n/a - 14.9 inHg
PCurr	Max	14.5 inHg	14.0 - 16.0 inHg
PCurr	Max	14.5 inHg	n/a - 14.9 inHg
RH from AH Calc	Min	N/A %	N/A - N/A %
RH from AH Calc	Max	N/A %	N/A - N/A %
AT-AH	Min	15.1 mg/l	N/A - N/A mg/l
AT-AH	Max	16.9 mg/l	N/A - N/A mg/l
AT-EO	Min	733.2 mg/l	N/A - N/A mg/l
AT-EO	Max	775.4 mg/l	N/A - N/A mg/l
EO Weight Used	Final	0 lbs	N/A - N/A lbs

DVN Current Phase Time has a measurement value of 00:09:34. The min specified value is 00:59:00

11. Phase » Vacuum

(Phase No.8)

Date / Time	[°F]	[inHg]
Avg.	Chamber Pressure	Gas Temp
13-Dec-16		
23:22:04	125.3	14.4
23:23:05	125.3	12.3
23:24:05	125.2	10.7
23:25:05	125.2	8.9
23:26:05	125.0	7.4
23:27:05	125.0	6.1
23:28:05	124.8	5.1
23:29:05	124.8	4.3
23:30:05	124.8	3.6
23:31:05	124.8	3.1
23:31:12	124.7	3.0
23:31:14	124.7	3.0

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	00:09:10	00:02:51 - 00:20:00
Elapsed Phase Time	Final	00:09:10	n/a - N/A
TempAve	Min	124.7 °F	120.0 - 130.0 °F
TempAve	Max	125.3 °F	120.0 - 130.0 °F
PCurr	Final	3.0 inHg	2.5 - 3.5 inHg
PCurr	Final	3.0 inHg	n/a - N/A inHg

12. Phase » Nitrogen Inject

(Phase No.9 - 1)

Date / Time	[°F]	[inHg]	[mg/l]
Avg.	Chamber Pressure	Gas Temp	AT-EO

9. Phase » EO Inject by Pressure

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure	[mg/l] AT-EO	[lbs] EO Weight Used
13-Dec-16				
22:54:25	125.3	3.5	30.1	8
22:55:25	125.4	4.3	58.2	11
22:56:25	125.4	5.3	110.3	16
22:57:25	125.4	6.3	167.8	21
22:58:25	125.4	7.2	223.4	25
22:59:25	125.5	8.3	286.5	30
23:00:25	125.5	9.3	347.5	35
23:01:25	125.5	10.3	404.4	40
23:02:25	125.5	11.3	457.8	45
23:03:25	125.5	12.3	519.3	50
23:04:25	125.5	13.3	579.4	54
23:05:25	125.5	14.3	639.9	59
23:05:29	125.6	14.4	646.1	60
23:05:34	125.6	14.5	655.8	60

Step Gas Usage

ID	Gas	Drum S/N	Lot Number	Usage Value
511	EO	E001214	UTLX902730L16	60lbs

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	00:12:10	00:06:27 - 00:25:48
Elapsed Phase Time	Final	00:12:10	n/a - N/A
TempAve	Min	125.3 °F	120.0 - 130.0 °F
TempAve	Max	125.6 °F	120.0 - 130.0 °F
PCurr	Final	14.5 inHg	13.9 - 15.9 inHg
PCurr	Final	14.5 inHg	n/a - 14.9 inHg
AT-EO	Final	655.8 mg/l	N/A - N/A mg/l
EO.Weight Used	Final	60 lbs	N/A - N/A lbs

10. Phase » EO Dwell

(Phase No.7)

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure	[mg/l] AT-EO	[lbs] EO Weight Used	[mg/l] AT-AH	[%] RH Sensor
-------------	-------------------------------------	-------------------------------	-----------------	----------------------------	-----------------	------------------

13-Dec-16

23:05:34	125.6	14.6	656.3	0	N/A	N/A
23:06:35	125.6	14.5	672.9	0	N/A	N/A
23:06:50	125.5	14.5	672.9	0	N/A	N/A

OPR: Operator has requested abort

DVN: Current Phase Time has a measurement value of 00:01:16. The min specified value is 00:59:00

Process Run Record

Sterigenics International, Inc.
7775 S. Quincy Street
Willowbrook, IL 60527
Tel: +1 (630) 654-5151

Run ID:	304146	Pallet Count:	0	Equipment:	Chamber K
Customer:	Sterigenics International			Workorder Num:	1860463
Specification:	17.1	Checksum:	-24959	Cycle:	Antares Cycle 751/CV 22130
Description:	ENG #10 12DEC16				
Date Started:	13-Dec-16 21:25:41			Date Completed:	
Date Aborted:	13-Dec-16 23:06:50	Aborted!		Aborted By:	Ray Cruz

1. Phase » General Configuration

(Phase No.0)

Date /
Time

13-Dec-16

21:25:41

SYS: Run ID 304146 has started

2. Phase » Start-up Phase

(Phase No.1)

Date / Time	[°F]	[inHg]
	Avg.	Current
	Chamber	Pressure
13-Dec-16		

21:25:41

123.7 29.9

21:25:42

123.7 29.9

21:25:46

123.7 29.9

3. Phase » Vacuum

(Phase No.2)

Date / Time	[°F]	[inHg]
	Avg.	Current
	Chamber	Pressure
13-Dec-16		

21:25:46

123.7 29.9

21:26:47

123.6 27.0

21:27:47

123.5 24.8

21:28:47

123.4 23.1

21:29:47

123.4 21.4

21:30:47

123.4 19.6

21:31:47

123.3 17.6

21:32:47

123.3 15.7

21:33:47

123.3 13.8

21:34:47

123.2 11.8

21:35:47

123.2 10.1

21:36:47

123.2 8.4

21:37:47

123.2 7.0

21:38:47

123.2 5.9

21:39:47

123.2 5.0

10. Phase » EO Dwell

Device	Summary	Summary Value		Specified Range
Current Phase Time	Final	00:01:16		00:59:00 - 05:00:00
Elapsed Phase Time	Final	00:01:17		n/a - N/A
TempAve	Min	125.5	°F	120.0 - 130.0 °F
TempAve	Max	125.6	°F	120.0 - 130.0 °F
PCurr	Min	14.5	inHg	14.0 - 16.0 inHg
PCurr	Min	14.5	inHg	n/a - 14.9 inHg
PCurr	Max	14.6	inHg	14.0 - 16.0 inHg
PCurr	Max	14.6	inHg	n/a - 14.9 inHg
RH from AH Calc	Min	N/A	%	N/A - N/A %
RH from AH Calc	Max	N/A	%	N/A - N/A %
AT-AH	Min	N/A	mg/l	N/A - N/A mg/l
AT-AH	Max	N/A	mg/l	N/A - N/A mg/l
AT-EO	Min	656.3	mg/l	N/A - N/A mg/l
AT-EO	Max	672.9	mg/l	N/A - N/A mg/l
EO Weight Used	Final	0	lbs	N/A - N/A lbs

DVN Current Phase Time has a measurement value of 00:01:16. The min specified value is 00:59:00

11. Phase » Vacuum

(Phase No.8)

	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure
13-Dec-16		
23:06:50	125.5	14.5
SYS:	Cycle has entered EO-Abort sequence while running Run ID 304146 at phase no: 8 - 0	
23:07:51	125.4	12.7
23:08:51	125.3	11.0
23:09:51	125.2	9.4
23:10:51	125.0	8.1
23:11:51	124.9	7.0
23:12:51	124.8	6.0
23:13:51	124.7	5.2
23:14:51	124.6	4.5
23:15:51	124.5	3.9
23:16:51	124.5	3.4
23:17:50	124.4	3.0
23:17:51	124.4	3.0
23:17:52	124.4	3.0

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	00:11:02	00:02:51 - 00:20:00
Elapsed Phase Time	Final	00:11:02	n/a - N/A
TempAve	Min	124.4 °F	120.0 - 130.0 °F
TempAve	Max	125.5 °F	120.0 - 130.0 °F
PCurr	Final	3.0 inHg	2.5 - 3.5 inHg
PCurr	Final	3.0 inHg	n/a - N/A inHg

12. Phase » Nitrogen Inject

(Phase No.9 - 1)

Process Run Record

Sterigenics International, Inc.
 7775 S. Quincy Street
 Willowbrook, IL 60527
 Tel: +1 (630) 654-5151

Run ID:	304143	Pallet Count:	0	Equipment:	Chamber K
Customer:	Sterigenics International			Workorder Num:	1860458
Specification:	17.1	Checksum:	-24959	Cycle:	Antares Cycle 751/CV 22130
Description:	ENG #8-12DEC2016				
Date Started:	13-Dec-16 12:43:04			Date Completed:	
Date Aborted:	13-Dec-16 18:49:43	Aborted!		Aborted By:	Ray Cruz
Additional Info:	EPA TEST				

1. Phase » General Configuration

(Phase No.0)

Date /
Time

13-Dec-16
12:43:04

2. Phase » Start-up Phase

(Phase No.1)

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure
13-Dec-16 12:43:05	124.9	29.9
12:43:09	124.9	29.9

3. Phase » Vacuum

(Phase No.2)

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure
13-Dec-16 12:43:09	124.9	29.9
12:44:10	124.8	27.0
12:45:10	124.6	24.8
12:46:10	124.5	23.2
12:47:10	124.4	21.5
12:48:10	124.4	19.6
12:49:10	124.3	17.7
12:50:10	124.2	15.7
12:51:10	124.1	13.8
12:52:10	124.0	11.8
12:53:10	124.0	10.0
12:54:10	123.9	8.4
12:55:10	123.9	7.0
12:56:10	123.9	5.9
12:57:10	123.9	5.0

9. Phase » EO Inject by Pressure

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure	[mg/l] AT-EO	[lbs] EO Weight Used
13-Dec-16				
14:11:42	126.1	3.5	27.1	8
14:12:42	126.1	4.3	56.4	12
14:13:42	126.1	5.3	110.0	17
14:14:42	126.2	6.3	164.4	21
14:15:42	126.1	7.3	231.6	26
14:16:42	126.1	8.3	288.4	31
14:17:42	126.1	9.3	350.4	36
14:18:42	126.2	10.3	404.4	40
14:19:42	126.2	11.3	463.3	45
14:20:42	126.2	12.3	522.3	49
14:21:42	126.2	13.3	584.0	54
14:22:42	126.2	14.3	645.1	59
14:22:46	126.2	14.4	650.1	59
14:22:51	126.2	14.6	661.5	60

Step Gas Usage

ID	Gas	Drum S/N	Lot Number	Usage Value
511	EO	E001214	UTLX902730L16	60lbs

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	00:12:10	00:06:27 - 00:25:48
Elapsed Phase Time	Final	00:12:10	n/a - N/A
TempAve	Min	126.1 °F	120.0 - 130.0 °F
TempAve	Max	126.2 °F	120.0 - 130.0 °F
PCurr	Final	14.6 inHg	13.9 - 15.9 inHg
PCurr	Final	14.6 inHg	n/a - 14.9 inHg
AT-EO	Final	661.5 mg/l	N/A - N/A mg/l
EO Weight Used	Final	60 lbs	N/A - N/A lbs

10. Phase » EO Dwell

(Phase No.7)

Date / Time	[°F] Avg. Chamber Gas Temp	[inHg] Current Pressure	[mg/l] AT-EO	[lbs] EO Weight Used	[mg/l] AT-AH	[%] RH Sensor
13-Dec-16						
14:22:51	126.2	14.6	661.6	0	N/A	N/A

SYS: Chamber was placed in hold mode while running Run ID 304143 at phase no. 7 - 0

OPR:	Operator has requested hold mode.					
14:23:52	126.1	14.5	676.9	0	N/A	N/A
14:24:52	126.1	14.5	672.9	0	N/A	N/A
14:25:52	126.0	14.4	673.0	0	N/A	N/A
14:26:52	126.0	14.4	672.9	0	N/A	N/A
14:27:52	125.9	14.4	673.9	0	N/A	N/A
14:28:52	125.9	14.4	684.4	0	N/A	N/A
14:29:52	125.8	14.4	672.9	0	N/A	N/A
14:30:52	125.7	14.4	673.0	0	N/A	N/A

10. Phase » EO Dwell

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	04:26:52	00:59:00 - 05:00:00
Elapsed Phase Time	Final	04:26:53	n/a - N/A
TempAve	Min	124.1 °F	120.0 - 130.0 °F
TempAve	Max	126.2 °F	120.0 - 130.0 °F
PCurr	Min	14.4 inHg	14.0 - 16.0 inHg
PCurr	Min	14.4 inHg	n/a - 14.9 inHg
PCurr	Max	14.6 inHg	14.0 - 16.0 inHg
PCurr	Max	14.6 inHg	n/a - 14.9 inHg
RH from AH Calc	Min	N/A %	N/A - N/A %
RH from AH Calc	Max	N/A %	N/A - N/A %
AT-AH	Min	N/A mg/l	N/A - N/A mg/l
AT-AH	Max	N/A mg/l	N/A - N/A mg/l
AT-EO	Min	661.6 mg/l	N/A - N/A mg/l
AT-EO	Max	684.5 mg/l	N/A - N/A mg/l
EO Weight Used	Final	0 lbs	N/A - N/A lbs

11. Phase » Vacuum

(Phase No.8)

Date / Time	[°F]	[inHg]
	Avg.	Current
	Chamber	Pressure
13-Dec-16 18:49:43	124.5	14.5

SYS: Cycle has entered EO-Abort sequence while running Run ID 304143 at phase no. 8 - 0

18:50:44	124.5	12.7
18:51:44	124.5	11.0
18:52:44	124.5	9.4
18:53:44	124.4	8.1
18:54:44	124.3	6.9
18:55:44	124.3	6.0
18:56:44	124.4	5.2
18:57:44	124.4	4.5
18:58:44	124.4	3.9
18:59:44	124.5	3.4
19:00:41	124.5	3.0
19:00:42	124.5	3.0

Device	Summary	Summary Value	Specified Range
Current Phase Time	Final	00:10:59	00:02:51 - 00:20:00
Elapsed Phase Time	Final	00:10:59	n/a - N/A
TempAve	Min	124.3 °F	120.0 - 130.0 °F
TempAve	Max	124.5 °F	120.0 - 130.0 °F
PCurr	Final	3.0 inHg	2.5 - 3.5 inHg
PCurr	Final	3.0 inHg	n/a - N/A inHg

12. Phase » Nitrogen Inject

(Phase No.9 - 1)

Date / Time	[°F]	[inHg]	[mg/l]
	Avg.	Current	AT-EO
	Chamber	Pressure	

Report Summary

Total number of steps: 13

Gas Usage Summary

Gas	Usage Value
EO	60 lbs

Deviations

Total Number of deviations: 0

All dates are expressed in the timezone: (UTC) Coordinated Universal Time

STERIGENICS
7775 S QUINCY ST
WILLOWBROOK, IL 60527
1-630-654-5151
CHAMBER NO. 2

SC 12 DEC 16

DATE 12/12/16 Mon
PROG VERSION KDRSCP V3Q-4
RUN NUMBER 1860427

CYCLE 751

**STERILANT EO
CHECK VALUE 22130
OPERATOR R CASTELLAND**

CUSTOMER	MAINTENANCE
LOT NO.	ENG #1-12DEC2016
QUANTITY	NA
PRODUCT	NA

IRRENT TANK: LOT # E001579UTLX982730L16, TARE 266.0 LB
GROSS WEIGHT 355.0 LB, STERILANT LEFT 84.0 LB

PROCESS PARAMETERS

CHAMBER TEMP 125 F, COOL AT 135 F, BLOWER IS USED, ALARM REPETITION 15:00 MM:SS
 VACUUM A 2.0 INHG, 2.01 INHG/MIN, REQD 3.0 INHG
 LEAK TEST 0:05 HH:MM, TOLERANCE 0.2 INHG
 NITROGEN DILUTION 2 CYCLES; NITROGEN: 24.0 INHG, 1.51 INHG/MIN
 EVAC: 2.0 INHG, 2.01 INHG/MIN
 GAS A 1 CYCLES; INJ: 14.4 INHG, 1.00 INHG/MIN, ED
 GAS DWELL 14.4 INHG, -0.2 INHG, DWELL 1:00 HH:MM
 AFTER VACUUM 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN, REQD 3.5 INHG
 GAS WASH A 3 CYCLES RLS: 23.0 INHG, 1.51 INHG/MIN, NITR
 VAC: 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN
 REQD 3.5 INHG
 GAS WASH B 1 CYCLES RLS: 23.0 INHG, 1.51 INHG/MIN, AIR
 VAC: 3.0 INHG OR 0:45 HH:MM, 2.01 INHG/MIN
 REQD 3.5 INHG
 RELEASE 28.0 INHG, 1.51 INHG/MIN

TIME	PRESS	TEMP (DEG F)	RH	VAP	ETO	H2O	ALARMS & MESSAGES				ACTION TAKEN			
	INHG	Avg	%	GAS	MG/L	MG/L								
5:31	OPERATOR	SENSOR	CHECK	--	PR	99.8,	RH	121,	JWT	128,	VLT	81,	V6X	107
	CT1	124,	CT2	122,	CT3	124,	P01	122,	P02	80,	P03	80,	P04	80
	P05	80,	P06	80,	P07	80,	P08	80,	P09	80,	P10	80,	P11	80
	P12	80,	P13	80,	P14	80,	P15	80,	P16	80,	P17	80,	P18	80
	P19	80,	P20	80,	ETO	0,	H2O	14.0,	WT	355.0				
	OPERATOR	SENSOR	CHECK	--	PR	99.8,	RH	121,	JWT	131,	VLT	81,	V6X	107
5:45	CT1	124,	CT2	121,	CT3	123,	P01	122,	P02	81,	P03	81,	P04	81
	P05	81,	P06	81,	P07	81,	P08	81,	P09	81,	P10	81,	P11	81
	P12	81,	P13	81,	P14	81,	P15	81,	P16	81,	P17	81,	P18	81
	P19	81,	P20	81,	ETO	0,	H2O	15.7,	WT	355.0				
	OPERATOR	SENSOR	CHECK	--	PR	99.8,	RH	121,	JWT	132,	VLT	81,	V6X	109
	CT1	127,	CT2	123,	CT3	126,	P01	124,	P02	81,	P03	81,	P04	81
6:14	P05	81,	P06	81,	P07	81,	P08	81,	P09	81,	P10	81,	P11	81
	P12	81,	P13	81,	P14	81,	P15	81,	P16	81,	P17	81,	P18	81
	P19	81,	P20	81,	ETO	0,	H2O	19.9,	WT	354.9				